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Electric Elevated Roads. WE publish this week an illustrated article on the recent trials of the Daft motor on the Ninth Avenue elevated road. These experiments have unquestionably commanded great attention and made a deep impression on the public mind. They have shown the great superiority of electricity over steam in the matter of annoyance to the dwellers along the route, and we believe that they must show a great economy of electricity over steam, which is a point that more directly concerns the railroad company.

Neutralizing the Static Charge. ON another page will be found an interesting account of experiments made for overcoming the effects of static capacity of long telegraph lines, by which the annoying retardation of signals is removed. The method here adopted consists in introducing an electro-magnetic device having such an amount of self induction that, when discharged, it neutralizes the static of the line. While the employment of this means for the working of the ordinary Morse over cables is novel, its use is well known in the quadruplex in some systems of which the induction coil takes the place of the condenser for neutralizing the static of the line.

Improvements in the Storage Battery. WHILE improvements in detail upon the storage battery are being constantly made, it is only occasionally that we note a departure from ordinary methods of construction. We encounter some novelties, however, in considering the secondary battery recently devised by Dr. Louis Duncan, which we describe on another page. Dr. Duncan, while applying well-known principles, has embodied them into a combination which may be said to result in an intermediary between the Planté and the Faure types, and in which it is sought to obviate the difficulties encountered with either of these, at the same time retaining the advantages of both.

Electric Rents. As the public become and more accustomed to the electric light, their desire to have it extends not only to public places, but to private houses; and especially is this the case where central stations have been established. As pointed out in another column, the modern house depends largely for its convenience upon electricity; and what with the electric door push, burglar alarm, annunciator, electric heater, electric light, etc., the time seems not far distant when the servant girl question will find its solution. Most of the electrical conveniences just mentioned are now made the basis of special inducements to renters of houses, and probably in the future no house will be considered a desirable residence without provisions for the electric illuminant.

Electrical Scrap Books. THERE is profound wisdom in the advice, "when found, make a note of," and if we do not make the memorandum we are pretty sure sooner or later to want the information badly. One rarely sees an item or hears of anything connected with one's work of which at some time use cannot be made. One of our contributors, this week, Mr. H. F. Watts, offers some good advice on the subject of electrical scrap books, and tells of his own experience in this matter. Mr. Watts evidently reads with discrimination and stores up with judgment. It would be interesting to hear from other readers as to what they have done in the same line. In some respects, it strikes us, an "Index Rerum" is preferable to such a book as Mr. Watts describes, for the reason that it does not involve the destruction of one's files. Of course it is easy to get an extra copy of the paper cut up, but even then such a book must be indexed if it attains any size.

The Medico-Legal Report. ELECTRICITY having been designated by the legislature of this state as the method to be employed in dispatching criminals, there remains nothing to do but devise suitable means for carrying the law out. These were left in the hands of the Medico-Legal Society, and the result of their deliberations is given in the extract from their report which we publish in another column. At the meeting at which this report was adopted, opportunity was given to hear the opinions of electricians, and the points upon which particular stress was laid were of two kinds. In the first place the majority seemed to think that the substitution of electricity for the present mode was entirely unnecessary and uncalled for, as there were other means by which the result could be accomplished equally well, if not better, and with less of the horrors which naturally accompany such proceedings. On the other hand, several were of opinion that the designation of the alternating current as the kind to be adopted put a stigma on that system of electrical distribution which it did not deserve.

Warfare by Electricity. A ROMANCE of the Jules Verne style, by Frank Stockton, has just been begun in *Once a Week*, and it promises to be one of the sensations of the time. The story is based on a supposed war between the United States and Great Britain, in which the former country lets out to a war syndicate the contract for carrying on the struggle. The syndicate is composed of several enormously wealthy men who launch a number of "repellers" and "crabs" which are very successful in disabling the best men-of-war from England. Mr. Stockton gives electricity a great part in the conflict, and provides the strange American craft with "electric engines," which do their work in a marvelously neat and expeditious manner. In certain respects Mr. Stockton might be more specific and less grandiose in his descriptions of what electricity does, but his fiction is a clever foreshadowing of the leading role to be taken by electricity in the next big sea war. What with electric motors, electric lights, electric signals, electric torpedoes and electric launches, the navies of the world are already remarkable for the extent and variety of their equipment of electrical appliances, and perhaps when we reach the period selected by Mr. Stockton for his story, they will have become so thoroughly electrical as to verify some of his wildest dreams.

Gas Mains as Electric Conduits. THE gas interests and everything allied to them have in the past been looked upon as natural enemies of the electric light, and probably with reason. But, happily, this feeling of animosity is rapidly dying out, and in its place we find a willingness on the part of the gas men not only to acknowledge the true value of the electric light, but even to embark in its exploitation. With the way thus paved, it seems not improbable that the gas interests may, to a certain extent, prove a valuable aid to the projectors of the idea of placing electrical conductors underground in our large cities. We are led to this belief by the contemplation of the curious experiment, by one of the metropolitan gas companies, of connecting two of its works by means of a telephone wire placed in the gas mains, the first trial of which has, indeed, proved so successful that the practice is about to be extended by them on a larger scale. The results so far obtained indicate that even with the ordinary insulation wires may be successfully maintained in such mains, and that the destroying qualities of gas, so much complained of when the latter is added to the action of ordinary moisture, do not exist under the given circumstances. Of course, it is not to be assumed that such a system of running conductors can take the place of a regular one, especially adapted for that purpose, but as an auxiliary, the employment of gas mains as electric conduits seems to be by no means an Utopian scheme.

Electric Executions. THE Medico-Legal Society has now made its report as to the method that should be adopted for electric execution, and the would-be murderer can now acquaint himself as to the details of the manner in which he will be disposed of if he should receive a sentence of capital punishment. We must frankly admit that the plan does not commend itself to our notions of decency or propriety. An electrical execution will perhaps be less sloppy than one by guillotine or by blowing from guns, but it will not be less ghastly in its attendant circumstances. We notice that the newspapers are objecting to the clause that prohibits the publication of any details of executions under the new law. They stigmatize the provision as unconstitutional and express their intention to violate it. One can hardly blame them, and the case is such that the more we know of the working of the law the better able we shall be to judge wisely of its efficacy and value. In the meantime, if the dispute between Mr. Harold P. Brown and his Westinghouse opponents were allowed to be carried out on the terms of the proposed challenge, we should know something of electrical executions in advance of the enforcement of the new law. The tests are working their way through the animal scale, but no human sacrifice has yet been allowed. Mr. Brown is not satisfied with dogs, calves and mares, but is willing to risk his own life and that of Mr. Westinghouse. Perhaps it would be as well first to await the result of the application of electricity, as proposed, to the big elephant, "Chief."

Preventing Sparks. THERE is hardly a practical application of the electric current in which the circuit is not at one time or another interrupted by the operation of the apparatus, and in which provision must not be made either in the construction of the apparatus or by external means, to prevent the sparking due to the extra current. This is especially the case in apparatus embracing electro-magnets, and from the Ruhmkorff coil down to the dynamo various expedients have been employed for overcoming the spark, which is so destructive to the contact points between which it occurs. In another column we present an article in which this question is taken up with special reference to the consideration of the best means to be employed for obviating this difficulty under different conditions. It is evident that a spark produced on the opening of a telegraph key is of a somewhat different nature in its origin to that which would occur in the making of a break in an induction coil, and that both of these differ in intensity and quality from the spark at the brushes of a dynamo. M. Vaschy points out the best means of overcoming the troubles when their different natures are known, and he shows that, according to cirrheostat, a voltameter and a condenser in shunt around the cumstances, the means to be employed may lie between a electro-magnet. The author also points out the best manner of interrupting the circuit when employing a rheostat, which increases in resistance progressively up to infinity, and shows what the breaks between the different sections of the rheostat ought to be in order to avoid dangerous sparking.

The National Electric Light Association.

A meeting of the Committee on Underground Conduits and Conductors of the National Electric Light Association was held at the association headquarters, 16 East Twenty-third street, New York, on Tuesday, Dec. 11.

The meeting was called to order at 2 o'clock P. M. by Mr. E. T. Lynch, Jr., chairman.

A preliminary discussion as to the present state of the art was entered into by the members present, and there seemed to be a very general impression that one of the most important things at present was to ascertain more fully and accurately than had heretofore been done, just what has so far been accomplished in this country touching upon the undergrounding of arc light conductors. Several plans for accomplishing this were discussed and the committee adjourned until Monday, Dec. 17, when definite plans for carrying out the committee work will be consummated. The members of this committee are E. T. Lynch, Jr., Chairman; I. H. Davis, F. B. Crocker, Gen. C. H. Barney and Walter C. Kerr.

NEW BOOKS.

KALENDER FUER ELEKTROTECHNIKER. 1889. By F. Uppenborn. Munich, R. Oldenbourg. 264 pp. Price, $1.60.

This excellent pocketbook has again undergone a thorough revision, and has been enlarged in many places. Besides an excellent and varied supply of the usual electrical data, the book contains the latest work in dynamo-electric machine construction, with many details not usually found in print.

FORTSCHRITTE DER ELEKTROTECHNIK. Edited by Dr. Karl Strecker. Berlin, 1888: Julius Springer.

This index to current electrical literature continues to fill the important place which it occupied from the start. The present number constitutes the index with running explanation of the contents for the first quarter of this year, with no less than 1,165 references to electrical articles, published in 65 different journals. The value of such a work to the student is incalculable, and we have ourselves found it to be a most valuable aid. The classification is so minute, and the addition of the index of authors which accompanies each yearly volume is so complete, that with it any article can be traced in the shortest possible time. The only thing to compare with it in the English language is the index published monthly by the American Institute of Electrical Engineers.

ETUDE THEORIQUE DES TRANSFORMATEURS. By Charles Jacquin. Paris, 1888: G. Masson.

This pamphlet of 27 pages is a reprint of an article which appeared in *L'Electricien*, in which the transformer is thoroughly discussed from the theoretical standpoint. The author begins by taking the transformer without iron, and then treats of the modern transformer and the method of determining the elements of its construction. For this purpose he calls to his aid the graphic method as being more easily applied than the mathematical, since the actions involved in the combination of an alternating current generator with a transformer are evidently very complex.

The Execution of Criminals by Electricity.

At the meeting of the Medico-Legal Society, held on Dec. 12, the final report of the committee on the best method of execution of criminals was submitted and called forth an extended discussion on the part of the members and of a number of electricians who had been invited to express their views on the question. The report as adopted, after reciting the experiments made by the committee, concludes as follows:

After mature deliberation we recommend that the death current be administered to the criminal in the following manner:

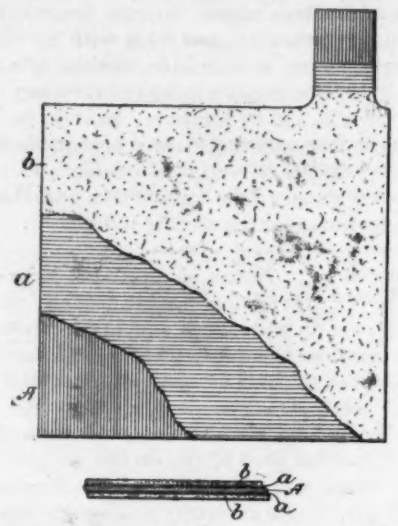
A stout table covered with rubber cloth and having holes along its borders for binding, or a strong chair, should be procured. The prisoner, lying on his back, or sitting, should be firmly bound upon this table or in the chair. One electrode should be inserted into the table, or into the back of the chair, that it will impinge upon the spine between the shoulders. The head should be secured by means of a sort of helmet fastened to the table or back of chair, and to this helmet the other pole should be so joined as to press firmly with its end upon the top of the head. We think a chair is preferable to a table. The rheophores can be led off to the dynamo through the floor or to another room, and the instrument for closing the circuit can be attached to the wall. The electrodes should be of metal between 1 and 4 inches in diameter, covered with a thick layer of sponge or chamois skin. The poles and the skin and hair at the points of contact should be thoroughly wet with a warm aqueous solution of common salt. The hair should be cut short. Provision should be made for preventing any moisture reaching from one electrode to the other. A dynamo capable of generating an electromotive force of at least 3,000 volts should be employed, and a current used with a potential between 1,000 and 1,500 volts, according to the resistance of the criminal. The alternating current should be made use of, with alternations not fewer than 300 per second. Such a current allowed to pass for from 15 to 30 seconds will insure death.

Dr. Duncan's Secondary Battery.

In the construction of secondary batteries heretofore generally employed, two kinds of plates have been used—viz., those consisting of a lead or lead-alloy base-plate or core, on which peroxide of lead, which forms the active material, is electrolytically formed, that is, of the Planté type, and those in which the base-plate or core is made of lead or lead alloy, and is provided with cells or recesses in which the active material is placed mechanically, or the Faure type.

In order to avoid the difficulties encountered with these types of secondary battery, Dr. Louis Duncan, of Johns Hopkins University, has, it would appear, for some time past been experimenting with a type of cell, the main feature of which consists in providing the supporting and and conducting base-plate or core with a protecting covering impervious to the electrolyte used in the battery, upon which covering the active material is applied. This protecting covering consists of a hard dense deposit of an oxide of lead applied in the following way: The supporting-plate or core is made the anode of an electrolytic bath containing an alkaline solution of a salt of lead, preferably a solution of litharge in caustic soda or potash. For the cathode of the bath a lead plate is employed. A very weak current is used, and while the electrolysis is going on an agitation is kept up, either by mechanically shaking the bath or the plates or by stirring the liquid by means of a blast of air.

The result of this is the formation on the anode of the cell of a deposited coating of an oxide of lead. This coating is of a black color, is very dense, hard, homogeneous and even, adheres with great firmness to the plate and is impervious to such solutions as are used in secondary batteries. It may be made as thin as desired. It adds stiffness to the plate, but is sufficiently flexible to bend



FIGS. 1 AND 2.—THE DUNCAN SECONDARY BATTERY.

with the plate if necessary. According to Dr. Duncan, such a covering may be applied to plates of any form and material. External to this covering there is placed the active material, consisting of peroxide of lead of a loose or porous formation, which may be formed or applied by the well-known processes.

The accompanying illustrations, Figs. 1 and 2, show a plate of the battery in side view and in section. The conducting plate *A* is coated on both sides with the hard, dense, impervious coating of lead oxide *a a*, and *b b* is the external active material.

It will be seen that the impervious layer between the core and the active material shuts off the former from all electrolytic action when in use, so that the same is merely a support and a conductor, and is not appreciably affected or changed in any way by the action of the battery. This being so it enables the thickness and weight of the plate to be largely decreased, while at the same time it permits of the employment of a metal other than lead and having greater strength and conductivity, such as copper. In addition, the layer of active material may be made much thinner than that usually employed, so that the local action will be decreased proportionally. On the other hand, the active layer can be made thick enough to represent a much greater ratio than is usually the case, so that the efficiency of the plate is increased. Another advantage suggested is that with the thin plates a much greater charging and discharging capacity can be obtained in proportion to the weight; and a much greater number of plates can be assembled in a cell of ordinary size.

PHOTOGRAPH OF SPARK OF WIMSHURST MACHINE.

With this type of cell the durability of the plates is much increased, the base-plate remaining unchanged, and there being little or no effect on the active material.

The Duration of Lightning Flashes.

It is well known that the lightning flash, or the spark between the terminals of an influence machine, exists for so short an interval of time as to be beyond measurement by any ordinary means. But notwithstanding the acceptance of this knowledge, the peculiarities of some of the flashes photographed have been supposed to be due to the camera or the sensitive plate, being at the time in a state of vibration. To test this line of thought, says *Engineering*, Mr. James Wimshurst has made a dark slide for his camera, in which is fitted a train of clockwork carrying a disc, upon which is an arrangement for holding the sensitive plate. When all is complete for photographing a flash, the clockwork is wound up, the sensitive plate then rapidly acquires great velocity, which at the maximum reaches 2,500 revolutions per minute, and with the plate rotating at this speed, the spark is photographed. The annexed engraving is from a photograph taken under these circumstances; as will be seen, it in no way indicates movement in the sensitive plate, for the photograph throughout its length is as sharp and as clear as though the plate had been at rest. The experiment is interesting, for it not only shows the infinitely short existence of the spark, but it also shows that chemical change in the sensitive film takes place in an equally minute interval of time.

Obituary.—Lucien Gaulard.

The death of M. Lucien Gaulard took place in Paris on Monday, the 26th inst. M. Gaulard was born in 1850, and was well known in French and English scientific circles. His name is associated principally with the system of electrical distribution by secondary generators, which occupied his sole attention during the last six or seven years; his earlier efforts were devoted to various branches of electrical and chemical science. In 1881 M. Gaulard showed at the Electrical Exhibition in Paris his thermo-electric battery, which excited a great deal of attention. It was at this time that M. Gaulard was invited by Mr. Gibbs to come to London, and since then, up to the time of M. Gaulard's illness in the spring of the present year, he was a director of the National Company for the Distribution of Electricity by Secondary Generators (Limited). M. Gaulard was a member of the Society of Telegraph-Engineers, and was decorated by the King of Italy at the Turin Exhibition in 1884. He leaves a widow but no family.

Baudot's Isochronous Regulator.

M. Baudot has devised a new isochronous regulator for his multiple printing telegraph apparatus. The regulator consists of a movable mass of metal, capable of moving between two guide rods fixed transversely to the end of the motor shaft. Two powerful springs, which are also fixed to the end of the motor shaft, pull this mass of metal toward the centre of rotation. When the motor is in motion the strength of the springs is so arranged that if the speed exceeds a certain amount the centrifugal pull of the mass of metal stretches the springs and pulls the shaft against the bearings, and by increasing the friction reduces the speed to its normal value. This arrangement merely constitutes a speed regulator; but it is converted by M. Baudot into an isochronous regulator by establishing a suitable relation between the centre of rotation, the centre of gravity, and the points to which the springs are fixed. The apparatus was specially constructed to maintain the uniformity of speed of the distributor employed in M. Baudot's printing telegraph under variable conditions of power and work. The additional work introduced by friction varies from 5 to 90 gramme-metres. The variations of speed arising from changes of temperature are pegligible, amounting as they do to only one-tenth per cent.

Anti-Induction Telephone Devices.

To the Editor of The Electrical World:

SIR: I read your description of Mr. Lockwood's patented anti-induction apparatus with interest, as it appears identical with what our company has been using during the past eight months.

My first experiment was to adapt the ringing-off coils at "central" to this purpose, by connecting one end of the coil to the connecting cord and grounding the other. The inequality of balance due to connecting varying lengths of line proved this to be impracticable. My second attempt was to use the call bell coils, which resulted better, but not as well as represented in your description although I used over 50 coils of different resistance and construction.

This idea was first suggested to me while speaking over a line one night and noticing the marked difference in the induction between it and another of the same length and route, which I had used shortly before. Investigation revealed that the former was crossed by a short line giving the induction two comparatively easy courses to the ground via "central," indicating coil and bell magnets of the instrument; but offering to the rapidly varying and vibrating current from the telephone a high retrocessive antagonism.

Dynamos with armatures constructed on the continuous winding system like the Gramme or Siemens, are the least objectionable, as they produce an almost continuous current, while those built on the open circuit plan give off an extra or retrocession current of high tension at every change of commutator; which, next to the alternating system, is the most objectionable.

The Weston and Thomson-Houston are good types of the above, the former giving little trouble, while the latter creates a constant roar. This is possibly partly due to the difference of potential of these machines.

It is hoped that nothing but what will thoroughly eradicate the difficulty, without decreasing the result telephonically, will be adopted or allowed to retard the introduction of the inevitable metallic circuits.

JOHN R. QUAIN,
Electrician, Ottawa Telephone Company.

DECEMBER 8,

Experiments with the Daft Electric Railway Motor "Benjamin Franklin."

While the public trials of the "Franklin" have received due and discriminating notice from both technical and general press, very little description has appeared of the preliminary tests leading up to them. They were naturally conducted with a certain degree of privacy, and the subsequent exhibitions so fully occupied public attention that it would have been premature to exploit them earlier.

They signify, however, so much more to the professional mind than the runs of Nov. 25 and Dec. 5 as to demand a special notice.

The qualities which it was necessary to demonstrate were: 1. Tractive capability. 2. Speed. 3. Mobility and handiness. Deliberate and exhaustive tests were applied, which are considered to have resulted in fully establishing the "Franklin's" excellence in these respects.

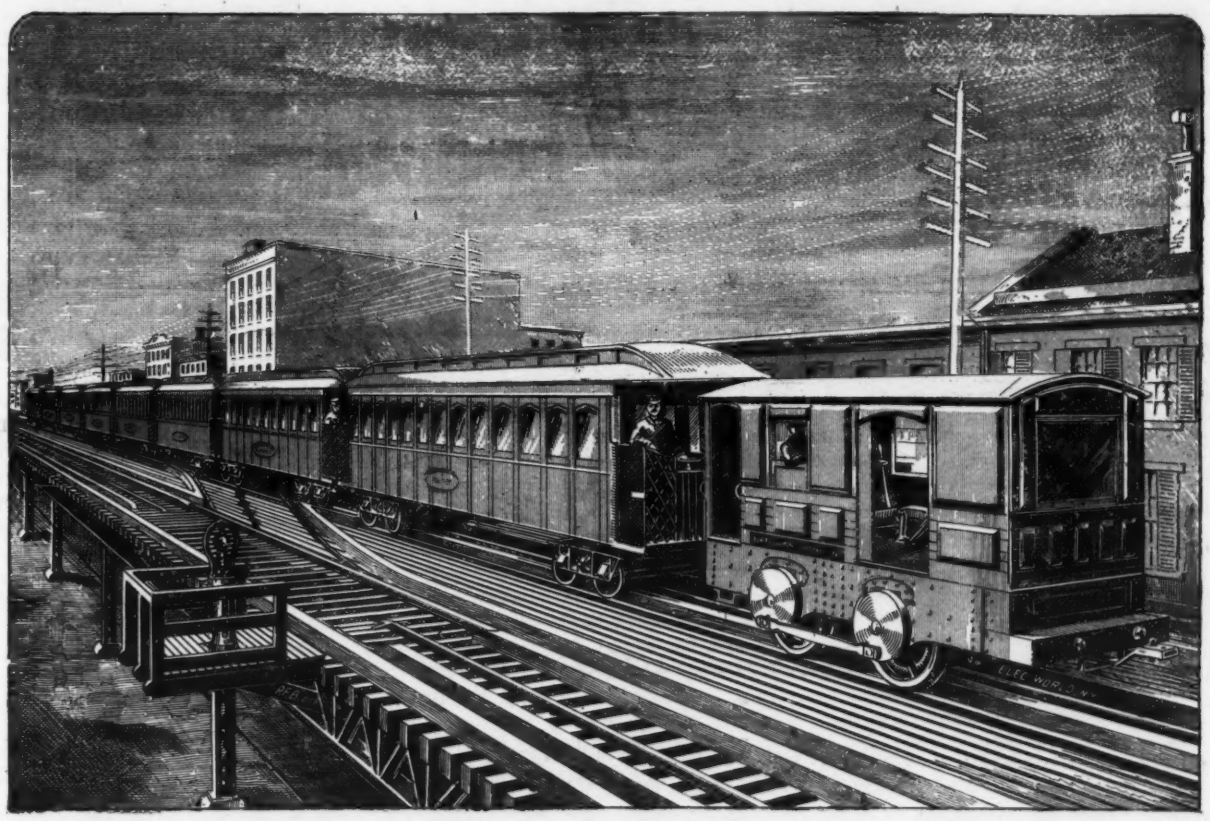
The tests for tractive capability were cumulative in their method and were abandoned only when the load drawn exceeded, by forty per cent., that which the motor was guaranteed to pull, and up to this limit there was not the faintest intimation of overload or strain of any kind. On the contrary, everything indicated that the motor was working well within its ultimate capacity and its prompt, responsive action in starting, acceleration and stopping was a surprise to the most sanguine.

The accompanying illustration shows how the load was applied. Eight empty cars were taken up the maximum gradient, nearly two per cent., at a speed of 7½ miles per hour, developing in so doing 120 h. p. Another achievement with this train consisted in backing it from the main line to a siding, and necessarily around the reverse curve connecting them, upon a gradient of 53 feet per mile.

The trials for speed under loads fell, on both occasions, upon the worst nights of the recent stormy weather, and, in spite of it, results were obtained equaling and exceeding the schedule speed of steam locomotives at ordinary service. With the standard trains of four cars and a little over half of the possible seated load, a speed of 15½ miles per hour was obtained, an excess of two miles per hour over the regular steam-traction speed, and this without effort or resort to ample means still available for its increase. On two occasions, with three empty cars, speeds of 30 miles per hour were obtained without taxing the motor in the slightest degree.

The free speed trials might have been carried to a much higher degree than they were, as the power limit was not nearly approached; but various considerations rendered it advisable to confine them to the specified conditions, the chief of which was an earnest desire to have the test continue to the end, as it was from the beginning, unattended by the slightest accident or disappointment. To this was added a strong unwillingness to trespass longer than indispensable upon the unstinted courtesy of the elevated railway officials.

On the point of mobility and handiness, a short anecdote will exhibit fully its completeness. During preliminary trials, while handling a train of six empty cars—a total load of ninety-four tons—it became necessary to shunt the train on a siding to permit the motor to be in front on the return trip. The standard train on the Ninth avenue line is composed of four cars and the sidings are built of a corresponding length. In looking over the situation, before shunting, it was discovered that the siding was only four feet longer than the train, and great nicety of manipulation would be necessary to accomplish it, especially as the motor was unprovided with means for working the air-brakes, leaving the train entirely dependent upon hand-brakes worked by only two men. The attempt was made, however, and, by skillful handling of the motor and zealous use of the ordinary brakes, the shunt was successfully accomplished, the train coming to a complete stop within the narrow limit of four feet.



"BEN. FRANKLIN," WITH TRAIN OF EIGHT CARS.

Paris-Brussels Telephone.

The cost of the telephone line from Paris to Brussels is already covered in the first year's receipts. The income is now at the rate of 120,000 francs a year. It is proposed to institute a simultaneous service of telegraph and telephone over this wire on the Van Rysselberghe system. The telephone system employed on this line is that of Dejongh, now in the hands of MM. Mourlon, of Brussels, who have obtained a gold medal for the system at the Brussels Exhibition, and have put up a number of telephone exchanges in Spain, Italy, Egypt and Mexico, as well as in various English and Dutch colonies. The success obtained is greatly due to the absence of the necessity for adjustment and the extreme clearness of the speaking.

New Method for Improving the Working of Long Telegraphic Lines.

BY M. FERNAND GODFREY.

This method consists in establishing at each extremity of the line at the entrance to the telegraph station an earth shunt having a coefficient of self-induction so considerable that the well-known injurious effects resulting from the electrostatic capacity of the conductor during the variable period of the current may be, if not compensated, at least greatly reduced by the inverse effects due to self-induction.

It is applicable to different systems of transmission, which may be divided into three classes: 1. Those in which all the impulses, whatever their character, positive or negative, should produce a signal and are separated by intervals, during which the line ceases to be in communication with an electric source. 2. Those in which the line is always in communication at the transmitting station with a battery sometimes positive and sometimes negative, the positive currents being used as working currents or printing currents, and the negative currents as currents for cessation or for spacing. 3. Those which partake at once of the two former—as, for instance, certain transmitting apparatus with discharge currents.

In the first case the shunt affords at the beginning of the impulse, and in virtue of its electro-magnetic inertia, an apparently considerable resistance, and it does not sensibly weaken the current which charges the line. It gives rise then at the end of the impulse to an extra current, which acts to facilitate the discharge of the line, as an impulse of a contrary direction would do succeeding the former without interruption. The signals at the receiving station are thus more distinctly spaced, and the receiver at the sending station is protected against the effects of the discharge current or return current.

In the second case the shunt likewise gives rise at the moment of each inversion to an extra current, acting immediately and producing the same effect as if the reversing battery had been momentarily increased. It contributes, therefore, to diminish the duration of the variable period, and consequently to increase the speed of transmission.

In the third case its action is explained in the same manner as in the two others.

The above considerations concern the action of the shunt placed at the transmitting station. Now the complete system allows of a similar shunt at each end of the line. But it has long been known that an electro magnetic shunt at the receiving station favors the rapidity of the transmissions and the distinctness of the signals. This is an effect which has long been known and utilized, especially on the long aërial lines in India.

The presence of a shunt of the same nature, about the middle of the line, produces an analogous effect, as I have found experimentally, but it involves the employment at the extremities of the line of more sensitive receiving apparatus or of rather stronger batteries. The method being applicable, as has been said, to the generality of telegraph systems, whatever may be the apparatus at the terminal or intermediate stations (transmitters, relays, receivers, etc.), affords a means of substituting a simpler arrangement for the so-called processes of discharge, or of mechanical compensation or others which are now in use, especially in subterranean and in some submarine lines.

It has been successfully tried at the central telegraph station, with the sanction of the Administration, upon several underground lines at great distances, among others on that from Paris to Angoulême (500 kilometres). In the course of experiments with this last locality it has been found practicable to transmit at the rate of 20 words per minute with an ordinary Morse apparatus, without relays, intermediate or local, and utilizing only one direction of the current. The line had a resistance of 5,000 ohms and a capacity of 100 microfarads; the shunt, which comprised an electro-magnet with a closed magnetic circuit and a small auxiliary coil, had a resistance of 780 ohms and a coefficient of self induction equal to 12 practical units; the battery was formed of 50 Callaud elements.

Results equally satisfactory have been obtained with other apparatus, but the example given may suffice.

Experiments have proved that it is not practically indispensable to have a perfect neutralization of the inverse effects of the capacity of the line and of the self-induction of the derivation or shunt. The same electro-magnet has given equally good results on underground lines of from 250–350 kilometres; another has served for trials upon lines of 400 to 700 kilometres. It is sufficient for each fresh line to take the battery suitable for that line and then to vary somewhat the resistance of the auxiliary bobbin, or to break the magnetic circuit of the electro-magnet and remove some of the pieces of soft iron forming the keepers.

We may always for more delicate experiments have recourse to boxes containing a certain number of bobbins or of electro-magnets, arranged so that they may be grouped at pleasure.—*Comptes Rendus.*

Electro-Bleaching.

Mr. Hermite recently delivered a lecture at the University College, Nottingham, on the process of electrolytic bleaching with which his name is associated. He pointed out that advantages of the process were that every bleacher was enabled to produce his own bleaching agent, that there was greater economy than in the old processes, that the destruction of the fibre was inappreciable, and that the cost was constant. The first operation in the process was the electrolysis of a solution of magnesium chloride. By this the water and the salt were both decomposed, and the nascent oxygen of the water and the chlorine of the salt united, producing a very unstable compound, of intense bleaching power. The hydrogen gas and magnesium went to the negative electrode, and the latter formed magnesium oxide with the water, the hydrogen being disengaged. If in this liquor were introduced any colored vegetable matter, the oxygen compound above mentioned at once bleached it, whilst the liberated chlorine combined with the free hydrogen to form hydrochloric acid. This in its turn decomposed the magnesia, producing the initial chloride of magnesium. Therefore a complete cycle of changes went on in the process, and there was nothing exhausted except the water, which cost nothing. Mr. Hermite concluded by pointing out that in this process only half the motive power was necessary to bleach the same weight of colored material as in the old processes, thus effecting a saving of 40 or 50 per cent.

Fares to the Chicago Convention.—Secretary Garratt, of the National Electric Light Association, has received the following from Mr. W. Fleming, the secretary of the Passenger Department of the Trunk Line Association: "Mr. George F. Porter's application of the 10th inst. addressed to me has been considered by the Trunk Line Passenger Committee, and it i agreed that persons from points in this committee's territory who pay full tariff first-class fare going to the meeting shall be returned at one-third the highest limited rate on the committee's certificates; said certificates to be obtained of ticket agents at starting points (by whom they will be kept in stock), and to be indorsed by you at the meeting, in accordance with the terms of our explanatory circular, which will be mailed you later, as well as a copy of the committee's certificate." This rate applies to points east of Niagara Falls, N. Y.; Buffalo, N. Y.; Salamanca, N. Y.; Bellaire, O.; Wheeling, W. Va., etc.

An Electric Crane.

At Messrs. Herrmann & Co.'s wood-working factory in Dod street, Limehouse, London, there is now in use a portable and self-propelling crane driven by an electric motor. The premises, which are of an extensive character, are lit with about 300 incandescent lamps from a Crompton 18-unit dynamo, giving 110 volts. This machine also supplies the current by which the crane is worked. The crane is used for unloading timber from barges lying in the canal at the back of the building, and is required to transfer the load to any one of the several rooms on each floor of the warehouse. For this purpose the crane is mounted upon the flat roof of the building, where it runs on rails, which also traverse a wooden staging projecting over the canal. There is a sharp curve in one part of the track.

The specification, says the London *Electrician*, required that the motor should lift 15 cwt. as a maximum load, and should raise 10 cwt. at the rate of 80 feet per minute, that it should travel on the track at the rate of 80 feet per minute, and should slew at about the same speed. It was further specified that, if required, any two of these motions should be performed at the same time; but it was not required to hoist, travel and slew all at once. As a matter of fact, the plant, which was supplied by Messrs. Crompton & Co., has exceeded the requirements of the specification in every particular. The motor is capable of lifting several hundred weight in excess, it does its work more rapidly, and is able to undertake all three operations at the same time. For hoisting the full load a current of 50 ampères is required, for traveling and slewing 35 ampères, and for the traveling alone from 23 to 35 ampères, the E. M. F. being constant at 110 volts. The motor is shunt-wound, and runs at a constant speed of 835 revolutions. A few turns of wire are wound outside the magnets, and at starting this is placed in series with the armature, and has the double advantage of checking the excess of current and of insuring the excitation of the field. These coils are switched out of circuit as soon as the normal speed is attained. The mechanical devices are controlled by three levers and one foot brake, which are all easily controlled by the driver. The direction of running is never reversed, the reversals being effected by means of clutches, as shown in Figs. 1 and 2, which represent the gearing in plan and elevation. The motor drives the whole of the movements through a friction gearing of the Raworth type.

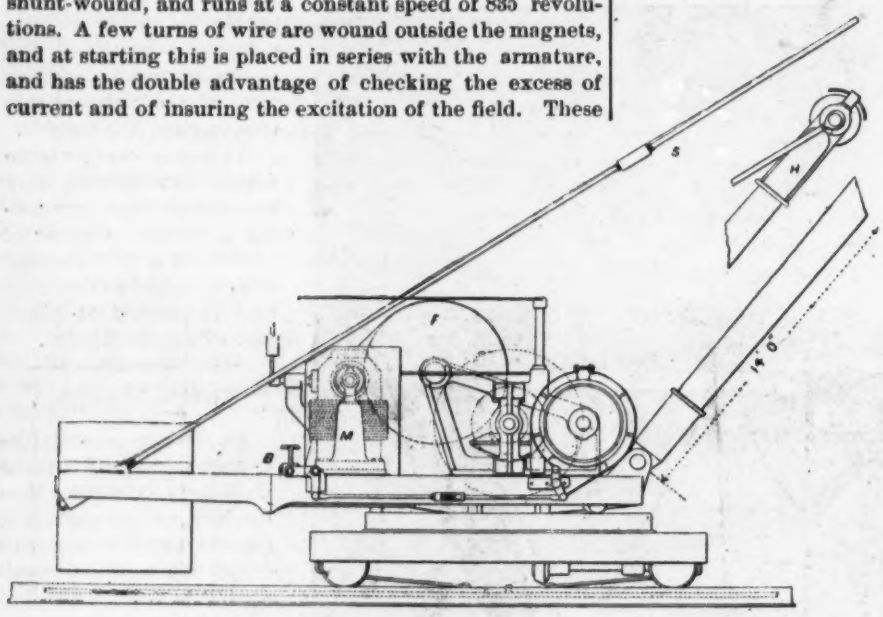


FIG. 1.—ELEVATION.

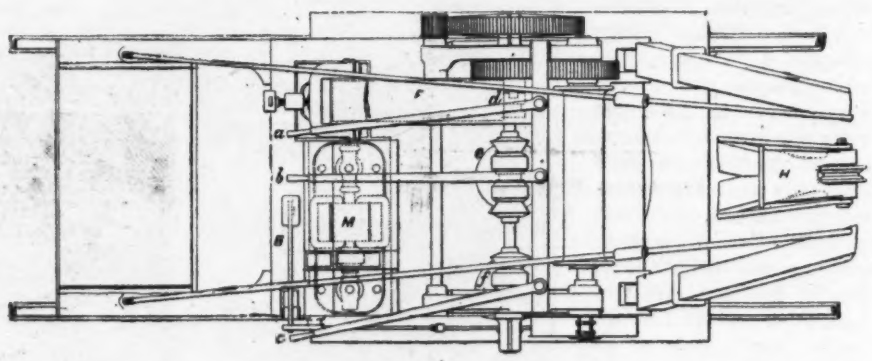


FIG. 2.—PLAN

CROMPTON ELECTRIC CRANE.

The letters on the engraving refer to the following parts: *M*, motor; *H*, head of crane; *F*, friction wheel; *S*, stay; *B*, brake foot lever, used for lowering; *a*, hoisting lever; *b*, traveling lever; *c*, slewing lever; *d*, hoisting fork clutch; *e*, traveling cone friction clutches; *f*, slewing cone friction clutches.

Minimizing the Baneful Effects of the Extra Current.

BY M. VASCHY.

The injurious effects of the extra current of rupture in a circuit of considerable self-induction are of two kinds. The sparks which burst at the point of rupture (primary circuit of the Ruhmkorff coil, brushes of dynamos, telegraphic apparatus, etc.), oxidize the contacts, increase the resistance, and reduce the useful effect of the current. From a physiological point of view, the danger of the extra current is still more serious, and may become deadly.

Various means have been proposed to lessen these effects: (1) A condenser employed in the manner of Fizeau, (Ruhmkorff's coil); (2) condenser in derivation between the extremities of the electro-magnet, (relays and telegraphic apparatus); (3) rheostat in derivation on a dynamo, (D'Arsonval, *Comptes Rendus*, January and March, 1885); (5) telegraphic lightning rod in derivation (Raynaud, *Comptes Rendus*, March, 1885), etc.

I purpose to show how the conditions of efficiency of these means may be submitted to calculation and expressed in figures. To this end we shall admit that for the suppression of these injurious effects the difference of potential at the extremities of the electro-magnet should not at any moment exceed a maximum E, the value of which has to be fixed (100 volts, 200 or 500 volts, as the case may be).

1. *Rheostat in derivation to the electro-magnet.*—Let R be the resistance of the electro-magnet, I the normal intensity of the current traversing it, ρ the resistance of the rheostat, the self-induction of which may be overlooked. On the rupture of the external circuit the electro-magnet and its shunt form a closed circuit, in which the current sinks gradually from I to zero. The maximum difference of potential V at the extremities of the shunt, and consequently at those of the electro-magnet, cannot exceed ρI. It results that the efficiency of the shunt will be secured if we take ρ less than $\frac{E}{I}$.

Example.—Morse electro-magnet ($R = 500$ ohms, $I = 0.015$ ampère = normal working current). If we wish that V should not exceed $E = 150$ volts, we only need give the shunt a resistance ρ less than 10,000 ohms.

If we take account of the very slight self-induction of the shunt, the result is not sensibly affected. The calculation would be too long to be developed here.

2. *Voltameters in derivation.*—We take voltameters of such a number that their maximum electromotive force e may slightly exceed the normal difference of potential $R I$ at the extremities of the electro-magnet. Let R be their resistance.

On repeating the above reasoning, we find that the maximum difference of potential V at the extremities of the electro-magnet during the rupture cannot exceed $\rho I + e$, or approximately $(\rho + R) I$. If the resistance ρ of the voltameters is small, V will scarcely exceed the difference of potential $R I$ of the normal condition.

By reason of their considerable capacity of voltaic polarization, the use of voltameters is suitable only in case of currents essentially variable (telegraphic transmission, alternating dynamos, etc.).

3. *Condenser in derivation on the electro-magnet.*—Let R and L be the resistance and the self-induction of the electro-magnet, I the normal current, C the capacity of the condenser. On the rupture of the external circuit, the electro-magnet and the condenser form a closed circuit, in which the current i declines gradually from I to zero. This current i causes the charge $C V$ of the condenser to decrease, and consequently the difference V of the potential at the extremities. When the discharge is complete, if the intensity i is reduced to zero, the extra current comes to an end without V having exceeded the normal difference of potential $R I$, the condition of efficiency is, of course, fulfilled. This case occurs when C exceeds the value of $\frac{L}{4 R^2}$ as a calculation in full would show.

But it may happen that when the charge of the condenser becomes zero, the current has still an intensity, $i < I$. The charge $C v$ continues then to decrease; v equally changes its direction and reaches a maximum, when the current i becomes null. Then the condenser discharges itself anew, and thus in succession. This is the phenomenon well known as the oscillating discharge. The point is to keep V below the fixed maximum E.

At the moment when the condenser is entirely discharged, the current having the intensity i, the energy still to be expended is $\frac{1}{2} L i^2 < L i^2$.

Then, since the intensity i has fallen to zero the energy still available is $\frac{1}{2} C V^2 < \frac{1}{2} L i^2$. Then, in order that V may be smaller than E, we must have

$$\frac{1}{2} L I^2 < \frac{1}{2} C E^2 \text{ or } C > \frac{L I^2}{E^2}.$$

This is a *sufficient* condition of efficiency; the *necessary* condition is obtained by a calculation too complicated for practice. We shall therefore adopt as the lower limit of the capacity C, the value $\frac{L I^2}{E^2}$ or the value $\frac{L}{4 R^2}$ if this is lower than the former.

Example.—Morse electro-magnet ($L = 10$, $i = 0.015$ *a*); if we fix $E = 150$ volt we must take C greater than 10^{-7} farad or $\frac{1}{10}$ microfarad.

4. *Case of an intentional rupture of the circuit.*—We may break a circuit by introducing resistances increasing progressively up to infinity. The duration of such a rupture must not be less than $\frac{L I}{E}$ if we wish the electromotive force of self-induction not to exceed the fixed maximum E. The law according to which it is advantageous to introduce the progressive resistances is easily calculated.

The other means which have been proposed or which might be studied with a view to reduce the bad effects of the extra current may be calculated in an analogous manner.—*Comptes Rendus.*

Electrical "Scrap Books."

BY H. FRANKLIN WATTS.

To those engaged in any branch of applied electricity, it is often desirable to preserve for future reference certain articles or passages that have appeared in the various electrical publications, and having reference to that special department in which they are engaged. Thus the telephonist seeking to keep pace with the march of progress, singles out the telephonic news, while the electric light engineer, equally interested, hails with delight any new development of his hobby or specialty. To preserve an entire paper with all its advertisements, when but a short article is required, is cumbersome, and often necessitates a long search through the pile before the desired item is found.

Great benefit may be derived by the use of a "scrap book," in which is collected such information as may be needed hereafter, and which can readily be referred to without difficulty.

As an illustration of what such a book should contain, the writer will describe his own scrap book, his interests being in the direction of general electric light engineering, with special reference to alternate current working.

The book is 12 × 16 inches and has 100 blank pages, each being of a size sufficient to accommodate a complete sheet from THE ELECTRICAL WORLD or any other journal likely to contain articles of interest. The covers are of heavy board, with Russia leather binding, and having inscribed thereon in neat gilt lettering "Electrical Scrap Book," together with its owner's name. If an entire article is to be preserved in the scrap-book it is fastened in the latter by mucilage applied to the narrow, unprinted portion of the page to be inserted. Both sides of the sheet can then be read by turning it over. If only one side is required, it is pasted in the ordinary way.

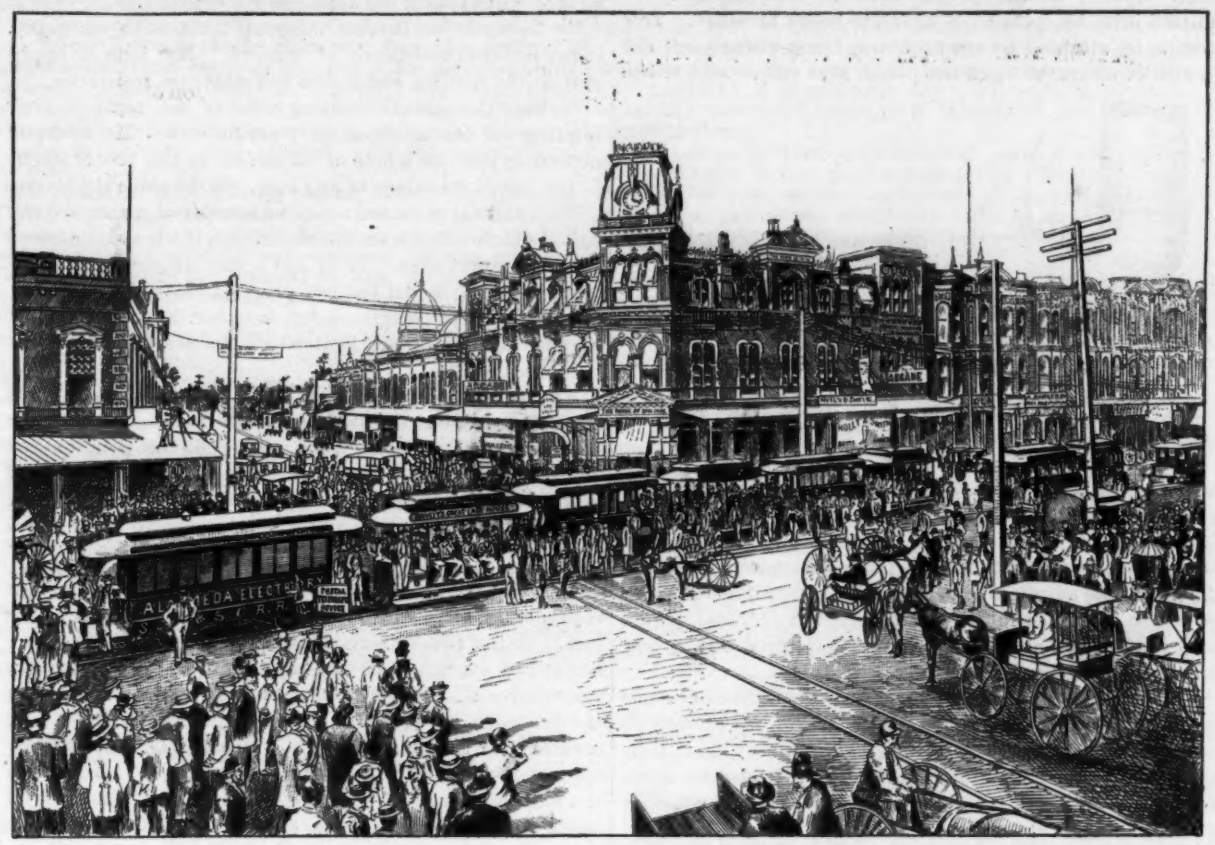
Opening the book we behold the portrait and biography of Prof. Elihu Thomson. This is placed upon the first page as a fitting tribute to his scientific standing. (Over the writer's desk hangs a framed copy of the portrait.)

Next in order comes the portrait of Mr. Edward Weston, and the following list of important publications with their accompanying illustrations: "Novel Phenomena of Alternating Currents," read by Prof. Elihu Thomson, before the American Institute of Electrical Engineers; "Description of the Thomson electric welding apparatus": "A Coulomb Meter for Measuring the Consumption of Electricity," by Prof. George Forbes; "The Energy of Alternating Currents," by O. B. Shallenberger; "The Westinghouse (Shallenberger) Meter for Alternating Currents;" "A New System of Alternate Current Motors and Transformers," by Nikola Tesla; The "New Westinghouse Motor and Station Switch-Board Arrangement"; "Phenomena of Magnetic Propagation," by Prof. Elihu Thomson and Merle J. Wightman; "The Deptford Central Station, Ferranti Alternating System," and many others of a similar nature.

It is now recommended that young men seeking for increased knowledge in any branch provide themselves with such a book as has been described, and fill it with matter of their own choice. They will thus secure to themselves a book of greater value than any volume that could be purchased.

The Fisher Road at San Jose, Cal.

We this week give another interesting view of the Fisher electric road on the shallow conduit system at San Jose, Cal. It is taken from a photograph, and illustrates very graphically the interest taken locally in the new enterprise. The fact has already been recognized that California presents a favorable field for electric railroads, and, probably, there are more such undertakings of the kind afoot in that State than in any other part of the Union. Owing to the general dryness of the climate, moreover, it has been argued that conduit systems have there an excellent opportunity to display their merits.



THE FISHER ELECTRIC ROAD, SAN JOSE, CAL.

Electrical Printing Presses.

There is no class of machinery to which the electric motor has been applied to which it is better adapted than printing presses. Especially is this the case where it is desired to have a press or a set of presses independent of the main shafting. In the case of isolated steam plants this would be a matter of considerable expense, and would be attended with considerable inconvenience, owing to the heat from the engine, the noise and the amount of floor space which would necessarily have to be given up. In the case of the motor it is quite different, as it is clean, noiseless and occupies in most cases a space which would otherwise be unfilled. The Thomson-Houston Electric Company have already made a great many installations in printing offices, one of which is illustrated in the accompanying engraving. It shows a portion of the establishment of Livermore & Knight, Providence, R. I., some of whose beautiful work is familiar to those who have seen the stationery of the American Electrical Works and other Providence concerns. This part of their office was previously run by a motor, but for some reason was to be replaced by steam. Permission was obtained to put the present motor in on trial pending the arrangements for steam, the result being so satisfactory that the motor was quickly accepted and recently replaced by one of greater capacity.

The Formation of Certain New Magnesium Compounds in the Electrolysis of Magnesium Chloride Solutions.

A paper entitled as above was recently read by Messrs. Cross and Bevan before the London Chemical Society. The authors have recently been engaged on an investigation of the chemical changes which take place in the electrolyte used in Hermite's process of electrolytic bleaching. They have found that under certain conditions a deposit is formed on one of the plates immersed in the electrolyte, and that this deposit on analysis indicated a compound containing at least two atoms of chlorine, one of which was available for bleaching purposes. It seems, then, that the compound formed by electrolysis of magnesium chloride solutions is similar in constitution to bleaching powder, viz , is a mixture of chloride and hypochlorite, or that a body which may be conveniently represented by the formula,

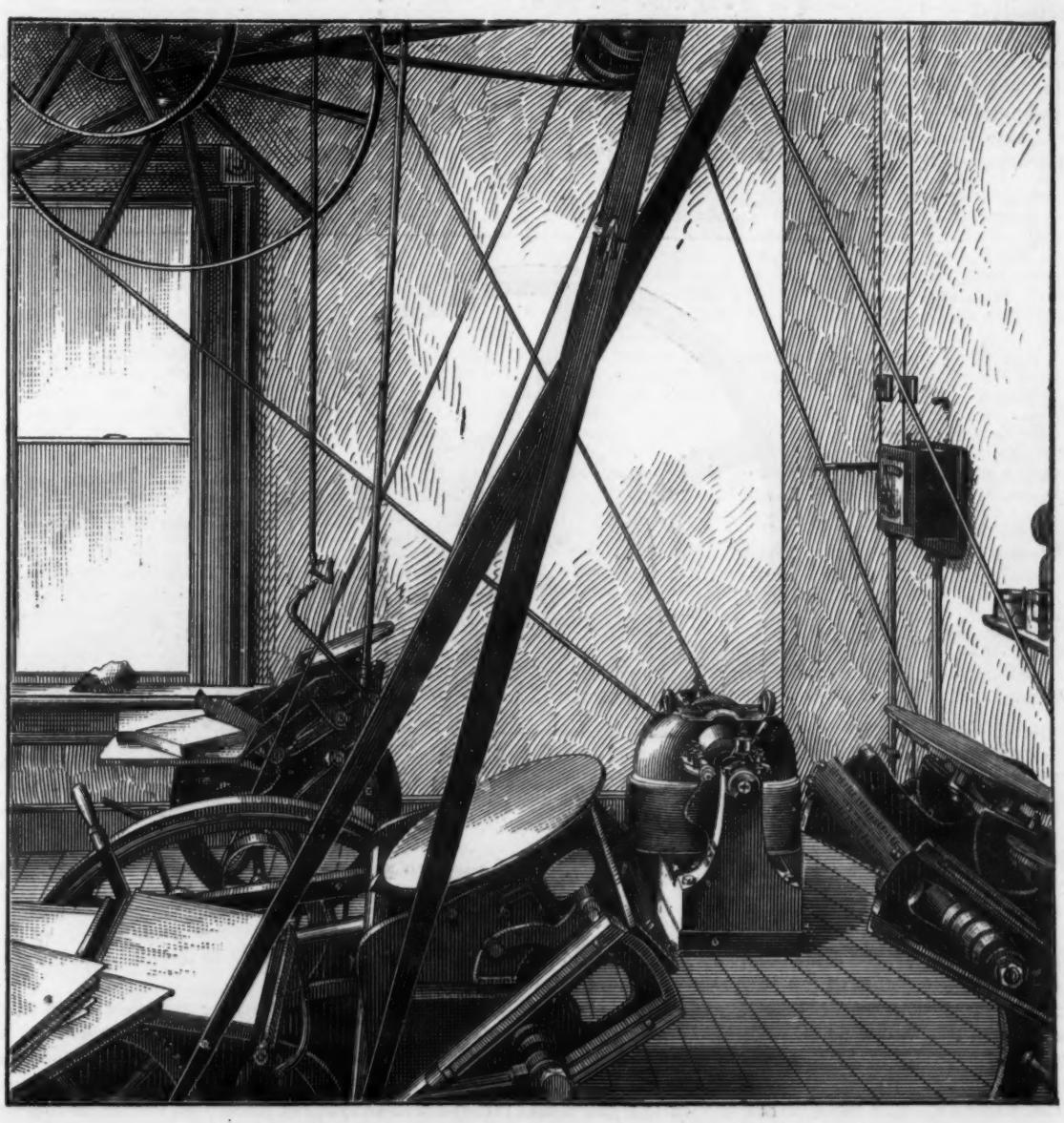
$$Mg\frac{O\,Cl}{Cl},$$

is produced. Similar compounds are produced with bromine and iodine. The authors, however, hesitate to assign any particular form la to the compound, as at present they have not y.t c pleted their experiments.

The Julien Storage Battery Patent Sustained.

We are in receipt of the following statement from the Julien Electric Traction Company : The Commissioner of Patents at Washington has just rendered a decision supporting Mr. Julien's claim for an inoxidizable alloy as against the claim of the Faure-Sellon-Volckmar combination. The Electrical Accumulator Company, of New York, with a view no doubt of testing the validity of Mr. Julien's patent, filed an application in the Patent Office some time ago for a patent, claiming among other things an alloy containing lead and antimony for a support plate in a secondary battery. The Patent Office thereupon put them in interference with the Julien Electric Company. Much expert evidence was offered on both sides. Prof. Morton, Mr. Reckenzaun and Mr. Madden testified on behalf of the Electrical Accumulator Company, and Prof. Barker, Dr. Vander Weyde and Mr. Salom testified on behalf of the Julien Electric Company. The case was then argued before the Commissioner by able counsel on both sides, and the Commissioner, after due consideration, decided in favor of the Julien Electric Company, holding that an alloy of lead and antimony had no novelty, but that an alloy of lead, antimony and mercury, as claimed by Mr. Julien, has specific advantages and novelty.

It was proved on behalf of the Julien Electric Company, and it has been admitted by the examiner in his opinion, that while an alloy of lead and antimony has serious disadvantages as a support plate by reason of the crystalline structure of the metal making it liable to oxidation and consequent disintegration, yet the presence of mercury removes this defect and makes the alloy homogeneous and practically inoxidizable.



PROVIDENCE, R. I, PRINTING OFFICE OPERATED BY THOMSON-HOUSTON MOTOR.

Dynamo Troubles.

To the Editor of The Electrical World:

SIR: Can any of your readers inform me as to the cause of the brushes on a No. 1 alternating current dynamo arcing at times with a sharp report? I have taken great care with them and had them very smooth and clean. They will run for two or three hours and then arc, and then run all right for a few days and then arc again, and so on. Also, at times the current does not come on as it should; it appears to stick, and when I touch my exciter brush it comes on at once. I take great care with the brushes and examine them every day. I would like very much to know if others have had similar experience and how the trouble can be obviated.

E. R. T.

FORT EDWARD, N. Y.

An Explanation.

To the Editor of The Electrical World:

SIR: At the end of Mr. Maver's rejoinder in the quadruplex discussion, page 316 of your Dec. 15 number, you very properly called a halt. I leave it to your judgment to decide whether your readers should not be in possession of the facts regarding my article as published in *The Telegrapher* as referred to. In *The Telegrapher* of March 13, 1875, "Occasional" says: "Mr. F. W. Jones, of Chicago, read a very interesting paper on the quadruplex. * * * I am in hopes I can get the paper for publication in *The Telegrapher*." The original paper as soon as presented to the society became its property, and went into the hands of the printers of the *American Electrical Society Journal* unchanged. Of all other matters your readers are quite intelligent enough to judge for themselves.

F. W. JONES.

DEC. 12, 1888.

Gas Mains as Electrical Conduits.

BY WM. MAVER, JR.

While it is quite probable that the idea of using gas mains as electrical conduits may have occurred to different people at various times, and especially since the question of getting rid of overhead wires has been so prominently before the public, it is more than likely that the first instance of the actual employment of those mains for that purpose is to be found in New York City.

About four years ago, when a new gas main was being laid between the gas works of the Consolidated Gas Company, of this city, at 99th street and at 111th street, on the east side, which works were to jointly supply gas to the mains in that portion of the city, it occurred to Mr. W. H. Bradley, the engineer in chief of the company, that in order to secure uninterrupted telephonic communication between the works, which is necessary, it would be well to try the experiment of placing a conductor in one of the new mains connecting the two establishments. This idea was carried into effect, and a cotton covered No. 14 B. W. G. copper wire was procured for the purpose. The experiment was from the first a decided success. A brief description of this novel arrangement may, therefore, be of interest.

The conductor enters the gas main in the sub-cellar of each building in the manner shown in the accompanying sketch, in which *S* is a "stuffing box" of peculiar construction screwed tightly to the iron shell of the main. In the centre of the stuffing box is passed a narrow glass tube *T* through which the wire enters the main. The glass tube is held firmly in position, and the stuffing box is made gas tight by the use of plaster of paris. The wire itself is suspended by wires attached to the upper portion of the main as shown to the right of the figure, in which a section of the main is removed for the purpose. The supports are insulated from the conductor by insulating knobs *K K*.

This conductor, which has been in continuous service for over four years, has been, as already said, a perfect success. During the blizzard of last spring it was the only telephone circuit in the gas company's service that was not inoperative. The circuit being composed of but one wire, is necessarily grounded at both ends. In length it is a little over half a mile.

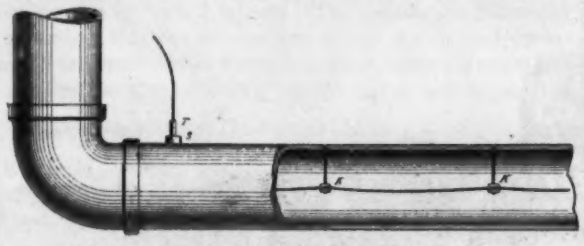
Apparently the conductor is in as good electrical and mechanical condition to-day as it was when first placed in the main. On one occasion, when it was necessary to open a portion of the main traversed by the conductor, the latter was seen to be encrusted with naphthaline crystals to the extent of about two inches, but this seemingly had no detrimental effect on the conductor.

Encouraged by the success which has followed the original experiment, the same company has taken advantage of the construction of a new series of mains in the upper part of the city of New York to place in those mains over five miles of three-conductor lead-covered cable to be used in maintaining telephonic communication between the different offices, works and headquarters of the company. The cable comes out of the gas mains through stuffing boxes at different points. The stuffing box used in this case is somewhat similar to that already described. It consists of a hollow cup screwed into the shell of the gas main. Inside of the cup is a tubular glass insulator which screws loosely into the cup. The cable passes into the main through the glass insulator, and the spaces are filled with plaster of paris. Inside the main, at intervals of about 12 feet, transverse boards are laid resting on the sides of the main. From these boards the lead-covered cable is suspended.

The officers of the company apprehend no detrimental action by the gas on the lead-covered cable,

The "Meyer" Electric Light Engine.

Our illustration represents the "Meyer" fixed cut-off engine built by the Davenport Foundry and Machine Company, of Davenport, Ia. The most important feature of the engine is its valve gear, which moves the valves with such rapidity at the proper moment that steam is admitted into the cylinder at absolute boiler pressure. This result is attained by the eccentric being always in the centre of its travel when the piston is at either end of the



A GAS MAIN ELECTRIC CONDUIT.

stroke, and just when the valve is at the point of opening and closing the ports.

The valve derives its motion from a bell crank lever operated by a single eccentric, cutting off the steam uniformly at half of the stroke and closing the exhaust at eight-tenths of the stroke. It is well known that in order to secure the greatest benefit from expansion, the steam should not be admitted into the cylinder beyond that point at which the speed of the piston begins to decrease, which is at half stroke, and this is here accomplished with a very simple and positive valve motion.

The valve is of the piston type, made as light as possible and fitted with spring rings, which travel in removable seats, either of which can be replaced in a very short time at a trifling expense without taking the cylinder from the frame; it is relieved from pressure, and having a constant travel always keeps steam-tight.

The speed of the engine shown in the engraving is regulated by means of a throttling governor, but the engine is also built with an automatic cut-off, ranging from three-fourths stroke to zero, and retains the same important feature of rapid valve movement.

Mr. Albion T. Snell on the Sprague Motor.

To the Editor of The Electrical World:

SIR: I note in your issue of the 10th Nov. Mr. F. J. Sprague's reply to my criticism of his "Richmond Curves." My paper appeared in the columns of the English *Electrician* for August 31, and probably few of your readers have seen it. Mr. Sprague's reply must be unintelligible to the majority. In justice to them and to me, I ask you to insert my criticism.

In my paper I published, for the first time I believe, a method of analyzing the action of electric motors by means of three variables, the determination of which depended on brake tests. I further showed by curves, taken from different types of machines, the errors likely to result from the use of electrical measurements only.

The Sprague curves I maintained were plotted from calculations based solely on electrical data. The superiority of my method seems so obvious that further discussion is unnecessary; in fact, Mr. Sprague admits the advantages to be gained by the use of brake tests as indicated in my paper. There are, however, a few misstatements in the reply, which I will briefly mention. Mr. Sprague gives three curves referring to one of his stock motors. The first he calls the "Sprague curve." It is presumably calulated from electrical data. The second he calls the "actual curve." I assume this to be obtained by a brake test. The third he calls "Snell's curve." How he obtained the figures of this I know not. The curve, if made according to my method, would show the *actual connection between the variables, speed and current.* If this be correctly plotted from the brake test, then Mr. Sprague's *actual curve* is wrong. Perhaps the experimenter will explain the apparent discrepancy.

Mr. Sprague has further misquoted me with reference to the internal resistance of motors. My figures apply only to the motors, and not to any external resistance.

Perhaps the most interesting point of the reply is that relating to the starting of tram-motors. Mr. Sprague prefers to put the whole of his device in the motor itself. I, for small machines at any rate, would place it outside.

The external resistance may be compared to a *throttle valve*, which wiredraws the electricity, if I may be allowed such an expression. It is not a very efficient arrangement, I grant; but it has two practical advantages. First, it is cheap and easy to keep in order; and, secondly, it spends the superfluous heat where the possible damage is a minimum.

Mr. Sprague's device resembles to some extent an *expansion valve*, but the analogy is not very complete. It enables a small current, with many convolutions on the fields, to do the same work per revolution of the armature that a larger current could do with fewer turns. But since the value of the motor electromotive force, and much more so, $\frac{\text{B. H. P.} \times 746}{c}$, is much decreased, the speed is proportionately lowered, and with it the efficiency. In fact, I do not think there is much to choose between either method if efficiency be the only criterion. However, the cumulative field device has this serious drawback. To lessen the first rush of current, on making circuit, the ohmic resistance of the motor must be considerable. This implies an extra outlay in the copper for windings. Also, since the total heat waste is confined to the motor, the risk of break-downs would appear to be increased. In large motors, say 15 or 20 horse-power and upwards, the conditions are somewhat altered. The magnets are usually so massive, and the characteristic so straight, that there is plenty of margin for some cumulative coils up to say that point where the characteristic is decidedly flat. The motor should not be expected to work beyond this part of the characteristic, for the efficiency falls so rapidly when this point is passed. I would, therefore, use an external resistance up to the flat part of the curve, and then vary the windings if further regulation were required. This latter arrangement corresponds approximately to the expansion lever and regulator of a steam locomotive, where, on starting, the lever is put in full gear, and the regulator opened slowly, so as to overcome the inertia of the load without undue shock or strain; then having acquired a certain velocity the lever is notched up to suit the conditions obtaining.

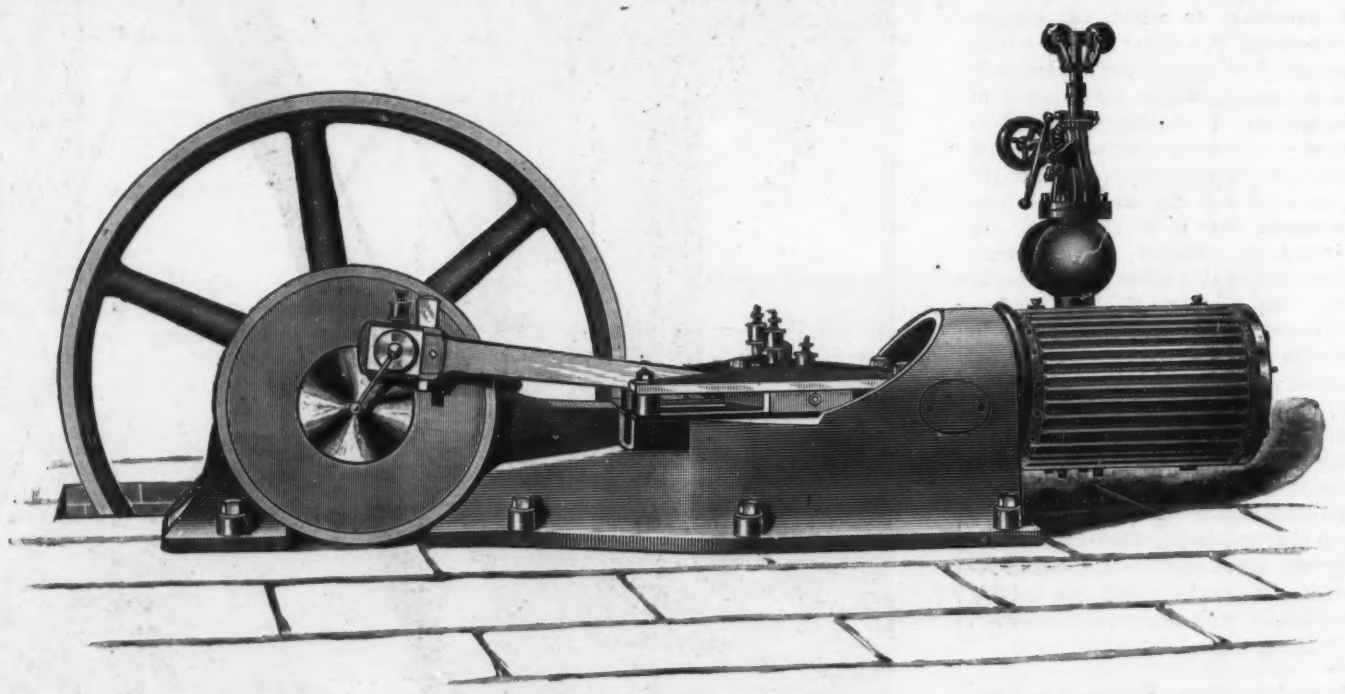
I think that most engineers will admit the justice of my mechanical parallel.

The figures for shunt motors quoted by Mr. Sprague are decidedly good, and agree well with English practice.

Concluding, I would thank Mr. Sprague for the information he has given us of American motors. I also assure him that English engineers are looking as eagerly as their American cousins for the success of electric traction in the United States, where circumstances have hitherto favored the enterprise.

Progress reported from across the Atlantic is always welcome, for it means as much solid gain to the whole industry as though it were in London itself. May I venture to hope that Mr. Sprague will shortly favor us with curves of his latest machines, embodying both his and my own method of treatment?

ALBION T. SNELL.



THE "MEYER" ELECTRIC LIGHT ENGINE.

The St. Joseph, Mo., Electric Roads.

The people in St. Joseph, Mo., are very enthusiastic in their praise of the electric street railroads, installed by the Sprague Electric Railway and Motor Company, in their city. The first contract signed was for the Union Passenger Street Railway, and this has been such a great success that the management has ordered an additional equipment of motors cars from the Sprague Company, and the Wyatt Park Street Railway of the same city has also ordered a complete electrical equipment. Since the installation of the Union Passenger Railway, this road has been visited by a large number of street railway directors from all parts of that section of the country, who have expressed themselves as very well pleased with the operation of the road.

One of the St. Joseph daily papers, in recently speaking of this road, says: "It should be a matter of pride to the citizens of St. Joseph that they are possessed of this electric railroad, for to say nothing of the material benefits accrued to the citizens by the increased service of the road, it is a thoroughly good advertising medium for our city. St. Joseph has a reputation abroad of having the first line of successful electric street railway in operation in the United States, and Mr. Steinacker says that a great portion of his every-day mail is made up of inquiries regarding the road and its working. Nearly every day some gentlemen are in St. Joseph from some other city to investigate the system, and they come from all parts of the United States. Yesterday, a gentleman from Portland, Oregon, was in the city for that purpose, and several days ago one from San Francisco on the same errand."

The work on the Wyatt Park Railway is being pushed forward as rapidly as possible by the Sprague Company, and it will not be long before all the cars will be in operation. These cars will be equipped with lightning arresters and universal movement trolley arm, noiseless gearing, flexible suspension for motors, and all the other devices which the Sprague Company has adopted for electric railways installed upon their system. St. Joseph should be congratulated upon its enterprise, and it is rapidly coming to the front among the Western cities for the application of electricity for power purposes.

On the Absolute Vacuum as a Non-Conductor of Electricity, and the Important Bearing of the Fact upon Electric Theories.*

BY DR. P. H. VANDER WEYDE.

The historical exhibition which I furnished at the American Institute Fair of 1887 contained several series which for want of space could not be separately shown, as would have been desirable, if space had permitted. In fact, everything was to a great degree mixed up for the reason referred to.

Among these series, electricity in vacuo formed a prominent and important feature, and because this is a subject so little understood, and even misunderstood, by the majority of electricians, and is also neglected in the text books, I felt induced to take this for my subject, when I was requested to address the society.

An additional reason was that it is of some practical importance, not so much in regard to its mechanical applications, as for the understanding and explanation of a great number of natural phenomena.

I will treat the subject historically, and therefore begin by calling your attention to the experiments of Nollet, recorded in this little book, published in Paris, 1753, and illustrated with carefully engraved figures. His experiments consisted in passing a current of static electricity through glass flasks, from which a large portion of the air had been previously removed by the air pump. He found that the electric current passed as a luminous stream which was very bright when the room was darkened, while luminous pencils were thrown off toward the sides of the flask, if they were touched by the fingers or any other conductor of electricity.

Some thirty years later a variation of this experiment was contrived, consisting of a strong glass tube of about two or three inches diameter and three or more feet long, provided with brass caps at each end, which could be conveniently attached to the air pump and exhausted. As the exhaustion proceeded, the rarefied air in the tube became a conductor of electricity, while this conductivity appeared to improve in proportion as the air was more exhausted. At last a regular stream of electricity was seen to pass through the tube, which stream resembled strikingly the luminous colored streams seen in the aurora borealis, wherefore such a tube was called the "aurora tube," and under that name is found in most philosophical collections.

This apparatus was exhibited at the fair, the exhibit consisting of an old historical air pump, made about 1780, with the aurora tube screwed on the top of it. A few other smaller devices of a similar nature were less conspicuous, and about them I wish only to remark, that, when using an ordinary air pump, it appeared that the conductivity of the air increased in proportion to the amount of exhaustion; hence the impression became prevalent that if we could only obtain a perfect vacuum, we would have the best of all conductors, and this idea is, unfortunately, even at the present day, shared by several prominent electricians who have not had the opportunity to keep themselves posted in regard to the discoveries made during the last few years, especially those made by Crookes, Gassiot, Spottiswoode, Gordon and others.

I must not omit to mention that before the latter discoveries Geissler, in Germany, began to furnish investigators with a great variety of glass tubes of various fanciful shapes, made of different kinds of glass and filled with various gases and vapors, exhausted by the air pump or by being heated, and then sealed up by the blow pipe, while platinum or aluminum wires were inserted at the extreme ends, so as to conduct the electric current through the rarefied gases inside. As those tubes exhibited a series of striking and beautiful phenomena, they became very popular, and no physical collection is considered complete without a set of such tubes. They give occasion to exhibit the auroral phenomena, and similar ones of the same character without the trouble of continually working the air pump.

I had two sets of such tubes on exhibition at the fair; one was extra large, the tubes being three and four feet long, and another set of tubes as many inches in length, and which I shall have the pleasure to exhibit to you tonight, being much easier and safer to transport than large tubes.

I will now proceed to make a statement of the facts as they are. They are startling and difficult to explain without the knowledge of the new conceptions of Professor Crookes regarding the nature of matter in the four different conditions, in which it presents itself to us.

The facts referred to are: The atmosphere in its ordinary condition is a very good non-conductor of electricity, provided it is perfectly dry and under a pressure equal to a mercurial barometric column of 760 millimetres or higher.

It is an important consideration, that if the air in which we live were a good conductor of electricity, man could never have become acquainted with electrical phenomena, as then static electricity could never have been collected, studied and experimented with; as this form

FIG. 1.

of electricity was the key to the other different forms, the latter would never have been discovered.

When rarefied by the air pump to a quarter of the normal pressure, the insulating qualities of air are not so good, and when reduced to a pressure of 10 or 20 millimetres it is a good conductor and exhibits the phenomena referred to before. As this is about the limit attainable by an ordinary air pump, it is very natural that experimenters became possessed of the idea stated above, that the conductivity of the air would keep on increasing as the exhaustion proceeded, but after the Sprengel mercurial air pump was invented, by which the air can be exhausted to a thousandth of a millimetre of mercurial pressure (which is about equivalent to one-millionth part of ordinary atmospheric pressure), it was found that the capacity of the air to show the auroral phenomena in the usual way ceased.

The electric current then behaves in a very different manner, as it radiates in straight lines and cannot turn corners, so that when the tubes are bent it gives occasion to very striking and novel phenomena, which were first brought forward by Professor Crookes in the tubes which are known by his name.

The difference between the Geissler tubes and the Crookes tubes is, that in the first the vacuum is very imperfect. In the Crookes tubes it is about a thousand times better, while if we succeed in making the vacuum a million times better, the conductivity of the air ceases absolutely. To accomplish this we must aid the function of the Sprengel air pump by some chemical device which will remove the last remnant of air. It then becomes an absolute non-conductor, which ordinary atmospheric air is not, because it is possible to pass currents of high tension in the form of an electric spark through the densest and dryest air. In the absolute vacuum, however, it is impossible to pass, over the space of a quarter inch, a spark which, when leaping through air, will be six or more inches long.

I exhibit here such a tube in which the two platinum wires are brought together within a distance of scarcely a quarter inch. In this tube a vacuum did exist so perfect that it was impossible to pass a spark through, which through air would leap over a distance of more than six inches. I found that the spark would rather pass over the outside of the tube for that distance than go through the interior. In order to satisfy myself that no trace of electricity passed through the interior space of a quarter inch, I connected one of the platinum wires with a Leyden jar, wound a brass chain half way around the middle part of the tube and connected this brass

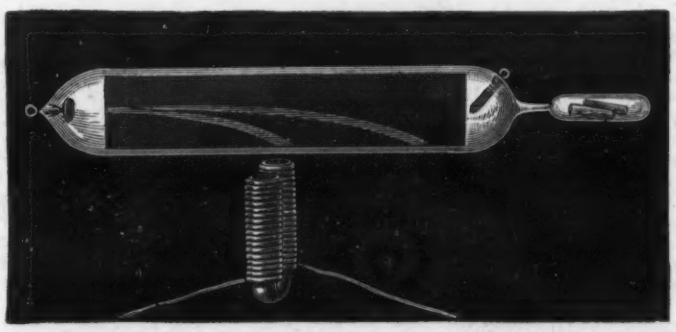


FIG. 2.

chain with the ground, in order to prevent any electricity from reaching the Leyden jar through the air along the outside, but I was not able to obtain the least trace of a charge in the Leyden jar. Later I increased the strength of the current more and more, until at last something happened in the tube which destroyed the vacuum; something volatilized, covering the sides of the glass interior with a blackish deposit, which may perhaps be platinum black, a thing which may not be impossible, if we consider that the electric discharge furnishes us the highest temperature which we can possibly produce by any means.

For more than 20 years I have preached this non-conductibility of a perfect vacuum, as it was proved by experiments with the Ruhmkorff coil, by de la Rive and Du Moncel. The latter describes the experiments in his book "Sur l'appareil d'induction de Ruhmkorff," published in Paris about 25 years ago.

It has not a little surprised me that the priority of this discovery is so remote as I found it to be, and that so important a fact as that of the non-conducting power of a perfect vacuum has been overlooked and ignored for nearly a century after it was proved by experiment. I found in the "Philosophical Transactions" for 1785, page 272, vol. 75, the extract of a paper read by Morgan before the Royal Society, and which I published eight years ago in the *Practical American*, which I edited at that time. The paper referred to states that a mercurial gauge 15 inches long, filled with pure mercury which was boiled in the glass until all air was expelled, was coated with tin-foil 5 inches down from its sealed end, and was inverted into the mercury in a little trough, through a perforation in its brass cap; the air over the mercury in the trough was then exhausted, when the mercury in the gauge fell down more or less in proportion to this exhaustion, but had always a perfect vacuum over it; if then the tin-foil coating the upper end of the tube was connected with the conductor of an electric machine, not the smallest ray of light nor the slightest charge could be produced in this exhausted gauge; but if the mercury had been imperfectly boiled, colored luminous phenomena were seen. The same was the case when the sealed end of a perfectly exhausted tube became cracked so that a little air had access; at first the electric charge passed with a yellow or green light; more air made the color a beautiful green, then blue, from blue to indigo; more air still, violet and purple, until the medium became so dense as to no longer conduct electricity. The writer closes with the observation: "I think there can be little doubt, from the above experiments, of the non-conductive power of a perfect vacuum. This seems to prove that there is a limit even in the rarefication of air, which sets bounds to its conducting power; or, in other words, that the particles of air may be so far separated from each other as no longer to be able to transmit electricity; that if they are brought to within a certain distance of each other, their conducting power begins, and continually increases, till their approach also arrives at the limit."

It is also a fact, known for more than a century by expert barometer makers, that the luminosity which shows itself in the dark in its vacuum, when a barometer is moved up or down in order to cause the mercurial column to oscillate in the same way, is only seen when the mercury has been boiled in the tube to a moderate degree; when the vacuum is made too perfect it shows itself feebly, or not at all, the same as is the case when the vacuum is contaminated with watery vapors.

So much for facts; now for the theory, which explains them and for which we are indebted to Professor Crookes. It gives us an inside view of the nature of matter in the conditions in which it presents itself to us, and is based on the theory of Dalton, that all matter consists of an immense number of infinitesimal particles, called atoms, which are indestructible, and in continual motion, which latter is also indestructible.

Astronomy teaches that in the planetary system we find a condition of things which is far beyond our ordinary conception based on our experience about things falling under the daily, immediate observation of our senses. First, the distances at which the celestial objects are placed are immense in proportion to their size, stupendous as it appears to us. Secondly, they are in a continuous motion, which is indestructible. Every planetary system is to us a perfect "perpetuum mobile."

Modern chemistry teaches the same doctrine in regard to ultimate atoms, which constitute that which we call matter. First, the distances of these atoms are also very large, in proportion to their size, which is infinitesimally small beyond our conception; secondly, these small particles or atoms are also in a continuous everlasting motion, as indestructible as is the motion of the planetary bodies.

As a concise statement of the modern philosophical conceptions in regard to this subject we say that, as the chemists of the past century proved, that apparent destruction of matter was only a transmutation of form, so the physicists of the present century have proved that apparent destruction of motion is also merely a transmutation of form, a change in the mode of motion; mass motion changed into molecular motion, which reveals itself as heat, light or electricity, or, vice versa, any of the latter forces into one another or into mass motion. Of this transformation the steam engine and the modern dynamo are forcible illustrations.

The great Swedish chemist Berzelius more than half a century ago expressed similar views, when he declared that the heat and light we see in an electric discharge, say, in a stroke of lightning, is not the electricity itself; he states most explicitly that the restoration of the electrical equilibrium, which, when destroyed, gives rise to what we call electrical phenomena, causes the evolution of sudden light and heat in the bodies through whose medium this restoration of equilibrium takes place, which light and heat then radiates and diffuses itself according to the ordinary well known laws of radiation and convection.

Crookes, in order to explain the peculiar behavior of electric discharges through his highly exhausted tubes, teaches the doctrine that our conception of three states of matters, solid, liquid and gaseous, is incomplete; he says that there is a fourth condition, which he calls radiant matter. He teaches as follows:

In solid bodies the atoms are in a state of rest; that is to say, as far as their relative position is concerned, but each atom oscillates to a greater or lesser degree. If the amplitude of the oscillation is small, we call the body cold; if the amplitude of the oscillation is large, we call the body hot; and, in so far, Crookes' theory agrees with what Tyndall has popularized in his well-known work, entitled "Heat as a Mode of Motion."

When the amplitude of the oscillations becomes so great that the atoms turn over and commence to rotate around their centres, the body reaches its melting point and becomes a liquid. Therefore, in liquids the atoms are not rigidly fixed to certain positions, but can freely roll over one another, and this constitutes the difference between solids and liquids.

When the velocity of the rotation becomes greater and greater, we say that the liquid is becoming hotter, and when from some cause or other this motion is still further increased, a new set of phenomena begins. The atoms are projected into space, and in place of rotating they are propelled from the liquid, and also repel one another, and as millions upon millions exist in the small space of a cubic inch, collisions take place by billions, and the body enters in what we call the "gaseous" condition.

Here we have entered a field for the conception of which very few are prepared. We are as little prepared for it as our ancestors were when Galileo and Copernicus, and later, Herschel, revealed to mankind the immensity of the universe. When at school, studying astronomy, we obtained some kind of conception of the infinitely large.

We are not yet educated to the conception of the infinitely small, which is a new revelation, which is as difficult to grasp with our finite mind as it is to grasp the infinitely large. In considering the latter, we speak of distances so

* A paper read before the N. Y. Electrical Society.

great that our common measures are utterly inadequate, and we must have recourse to larger standards of measures, such as the velocity of light connected with the time it takes to reach us from the most distant stars, which in some cases has been proved to be ten thousand years.

In considering the motion of the atoms of gaseous matter, we enter the other extreme of the conception of great and small. It appears that the number of atoms in one cubic inch of the common air we breathe is represented by a series of more than twenty figures, which particles or atoms are in constant continual collision to the number of ten million per second, while the velocity is so great that, if moving in a straight line, they would pass through a space of eleven thousand feet in a single second, thus surpassing the velocity of sound ten times. This is the nature of the third or gaseous condition.

The fourth condition, attained by the Sprengel air pump, is called by Crookes radiant matter. It is reached when the exhaustion proceeds so far that there are so few atoms left as to make the collisions exceptional; then the atoms will move in straight lines, and encountering no mutual hindrance to their motion they will follow the laws of electric repulsion and *radiate* from the point charged with electricity; hence matter in this condition is called "radiant matter."

Now we come to the most interesting feature of our consideration, namely, the chemical device referred to above, and intended to remove this last trace of air; recourse is had to the strong chemical affinitely of potash for carbonic acid. The exhausted tube is filled with carbonic acid gas and again exhausted, and this process repeated in order to make sure that no atmospheric gas is left, but only very rarified carbonic acid gas. A recess is connected with the tube, during the operation, in which recess is placed a small stick of pure caustic potash. This recess is heated by a spirit lamp, so as to drive out the carbonic acid which the potash may contain and then the vacuum is again made. The last remnant of carbonic acid which the air pump cannot remove is then absorbed by the potash, when this is allowed to cool down. In this way the absolute vacuum is produced, through which no electric current can be made to pass.*

The bearing of this fact is of the utmost importance in regard to our conception of the nature of electricity. It is generally admitted that the theory of the existence of a caloric fluid is erroneous, and that heat is merely a peculiar mode of motion, as referred to above, and this view is adopted, notwithstanding there is no experiment known serving to demonstrate that heat cannot be transmitted through a space absolutely devoid of all matter. Heat and light will both pass through a vacuum perfect enough to obstruct absolutely the passage of electricity. If there were such a thing as an electric fluid, it surely would pass through any empty space, and we are therefore driven to the conclusion that the presence of matter is as absolute a condition for the transmission of electricity as the presence of air is an absolute condition for the transmission of sound; and there is as little necessity to accept the hypothesis of the existence of an electric fluid as there is for the hypothesis of a sonorous or caloric fluid.

Air being the ordinary vehicle by which sonorous vibrations are transmitted, a proper degree of exhaustion will arrest this transmission, and any common air pump can be made to prove that sound is with difficulty transmitted through a partial vacuum, and not at all when the vacuum is somewhat nearer to perfection. This experiment is acknowledged to be intended for a demonstration that the air molecules are the media for transmitting sound; that without such a medium there can be no sound, and that there exists no peculiar sonorous imponderable fluid which pervades the air, and should be the cause of sound transmission. When now we see that more highly rarefied air behaves toward electricity in exactly the same way as the lesser rarefied air behaves toward sound, namely that at a certain degree of rarefaction, the transmission becomes more imperfect and at a certain point stops entirely, we are driven to the conclusion that electricity as well as sound is merely a peculiar form of motion of ponderable matter.

The conventional method of calling electricity a fluid must be understood to be only for the sake of convenience in explaining the phenomena presented. An argument in favor of this custom is, that electric currents behave like water in two respects, namely, moving under greater or smaller pressure and in greater or smaller quantities.

What in water is called pressure or head is in electricity called electromotive force, and as hydraulic pressure can overcome great mechanical resistances, so electromotive force overcomes great electrical resistances.

It is measured by a standard unit, which is properly called after the illustrious Italian who first invented an apparatus which multiplied the small electromotive force of a galvanic couple, the column of Volta. The quantity of electricity discharged through a channel is measured by another standard, also very appropriately named after the great French investigator Ampère, who discovered the laws governing the mutual action and reaction of currents of great quantity.

That rarefied air is by no means so good a conductor as assumed by many, is proved by the fact that it requires a considerable electromotive force to pass it through. Machines producing static electricity, either by friction or induction, give that high electromotive force, while a single large galvanic cell, or better still, a thermo-electric couple, offers the other extreme, viz., a large quantity of very low electromotive force, utterly incapable of being transmitted through any kind of vacuum.

I referred in the beginning of this paper to the application of the knowledge recently obtained in regard to the behavior of electricity in rarefied air and in vacuo for the purpose of explaining certain natural phenomena. These phenomena are principally the aurora borealis and australis, and especially those which are related to the immense enigmas which from time to time appear in the heavens, the comets, which alarm the ignorant. On a future occasion I hope to have the satisfaction to show you that all the peculiarities presented in both cases may be satisfactorily accounted for by the lately discovered facts to which I have called your attention to-night.

* Of the accompanying two cuts Fig. 1 represents an arrangement, similar to the tube exhibited at the lecture, while Fig. 2 shows that as the direction of the magnetic needle may be deviated by a wire conducting an electric current, vice versa, the direction of a flow of an electric current in a partial vacuum will be affected by magnetic influence, as shown by the results of charging and discharging the electro magnet seen below the tube.

Alternating Currents in Electric Light Wires.

The following from Mr. George Westinghouse, Jr., as president of the Westinghouse Electric Company, appeared in the New York *Times* last week;

I have been favored by a correspondent with an article printed in your paper describing an experiment made by one Harold P. Brown, at the Edison laboratory, in Orange, N. J., with the alternating current, and as your journal and others are likely to be misled, the public interests injured and very extensive vested interests also injured, I think it due to those whom I represent to ask the indulgence of your columns for some remarks on that subject.

It is generally understood that Harold P. Brown is conducting these experiments in the interest and pay of the Edison Electric Light Company; that the Edison Company's business can be vitally injured if the alternating current apparatus continues to be as successfully introduced and operated as it has heretofore been; and that the Edison representatives from a business point of view consider themselves justified in resorting to any expedient to prevent the extension of this system.

To show the absurdity of connecting the experiments made at Mr. Edison's laboratory at Orange, N. J., with the commercial use of electric currents, it is only necessary to call attention to the manner in which the current was applied. To use a simple illustration, a piece of lead weighing one ounce may strike the human body with great force in any one of 100 places without producing any permanent injury, and even when fired from a rifle must enter one of the few vital parts to have fatal effect, although when so directed it is perfectly easy to produce instantaneous death. The method of applying the current used in these experiments was carefully selected for the purpose of producing the most startling effects with the smallest expenditure of current, and regardless of any connection between the nature of the current and the special and extraordinary means used to apply the current for these experiments. The parts brought under the action of the current were not only those most easily affected by it, but were so carefully placed in the circuit as to receive a shock such as would be utterly impossible if the current were applied in any ordinary or accidental manner. In order to injuriously affect any organ of the body it is necessary that a certain quantity or volume of current pass through it for a greater or less time dependent upon the amount of the current. To thoroughly appreciate the case it must be understood that the current is increased to a given pressure in exactly the same proportion as the resistance offered to its passage is reduced. It was for this reason that a vital part of the body was selected (in the experiments at Mr. Edison's laboratory) that could be reached by the current without traversing any considerable portion of the body, and in addition to this the resistance of the contacts was made as low as possible by giving them a large surface and moistening the parts where the electrodes were applied. The result of this carefully arranged plan was that a large quantity of the current was made to pass through sensitive portions of the brain and spinal cord. The same current applied to any other portion of the body would not have been likely to produce any injurious result, and, moreover, in order to produce such a current it would have been necessary to very greatly increase the electromotive force, so that, instead of 700 volts, as claimed in the case of these experiments, several thousand would have been necessary to have the same effect. The usual points of contact in accidental shocks received from electric circuits are through the hands or some other portion of the body protected by tissues of greater or less thickness, and as a matter of experience, it has been found that pressures exceeding 1,000 volts can be withstood by persons of ordinary health without experiencing any permanent inconvenience. Further, the alternating current is less dangerous to life, from the fact that the momentary reversal of direction prevents decomposition of tissues, and injury can only result from the general effects of the shock; whereas, in a continuous current there is not only the injury from the latter cause but a positive organic change from chemical decomposition, much more rapid and injurious in its effects. A large number of persons can be produced who have received a 1,000 volt shock from alternating currents without injury, and among them a wireman became insensible and held his hand in contact with the wires for a period of three minutes without fatal results—in fact was able to go on with his work after a short period.

We have no hesitation in charging that the object of these experiments is not in the interest of science or safety, but to endeavor to create in the minds of the public a prejudice against the use of the alternating currents. The Edison Company, who are to be benefited by the dissemination of literature of this character, in their annual report, issued this fall, showed that during the past year they sold of their continuous current, 220 volt apparatuses, for central stations, to the extent of 44,000 lights for the current year. The Westinghouse Electric Company during the month of October, 1888, alone, received orders for 48,000 lights for central station use on the alternating current system, 25,000 of which were for use in London, where the laws with reference to the distribution of electricity are more carefully scrutinized than they ever have been in this country. Since the Westinghouse Electric Company began its business it has sold more central station plant on the alternating current system than all of the other electric companies in the country put together have of the continuous current system. This large business has been mainly due to the fact that the alternating current system permits the use of an electromotive force which brings the price of incandescent lighting within the reach of the multitude, and enables central station companies to distribute their current over any desired area, such as, for instance, the city of New York and other large places.

One word more with reference to the alternating system: It not only permits the use of a current of 1,000 volts for street mains, but requires its conversion into currents of 50 volts or less for house-wiring. The converters are so constructed that the primary or street current can never by any possibility enter the house. With the Edison system the pressure is about 220 volts, and while no person coming in contact with the alternating current as used for domestic lighting would be aware of its presence, with the Edison system the shock would be painful, if not absolutely dangerous, if the person were at all delicate.

We believe there should be reason and right in all things and that this company is perfectly justified in drawing the attention of the public to the reasons why Harold P. Brown conducts his experiments with alternating currents in the manner stated at the laboratory of Mr. Edison, since, if that company cannot counteract the inroads made into their business by the alternating system, they must necessarily continue to occupy an inferior place, and the protection of their vested interests has led them to use, as correct and proper, any methods that under other circumstances would hardly be resorted to. The Westinghouse Electric Company has introduced its alternating system at the present time into 130 central stations in this country and Canada, all within the brief period of two years. Thirty-six of these stations have increased their plant by ordering additional apparatus from this company after having started with their initial order, and we feel justified in saying that in addition to our own experience with the alternating system the business would not have had this enormous and rapidly increasing growth if there had been connected with it the dangerous features which Mr. Harold P. Brown and his associates of the Edison company so loudly proclaim.

Finally, we shall be glad to have you send an expert connected with your valuable paper, who is disinterested and competent, to investigate, free from prejudice, the subject of the alternating and continuous currents. We will afford him every opportunity to satisfy himself of the vast superiority as to safety and economy of the alternating system.

On the Magnetization of Iron and Other Magnetic Metals in Very Strong Fields.*

BY J. A. EWING, B. SC., F. R. S., AND WILLIAM LOW.

Early in 1887 the authors communicated to the Royal Society the results of experiments made by subjecting iron to strong magnetic force by placing the sample, in form of a bobbin with a short, narrow neck and conical ends, between the pole-pieces of an electro-magnet. The experiments have been continued and extended by using much stronger magnetic forces and by testing samples of nickel, cobalt, and various steels, as well as wrought iron and cast iron. The large magnet of the Edinburgh University Laboratory, kindly lent by Prof. Tait, was used throughout the experiments, and allowed the authors to effect a high concentration of the magnetic force by using bobbins the necks of which had a cross-sectional area of (in some cases) only $\frac{1}{1500}$ of the cross-sectional area of the magnet cores. By this means the induction $\mathfrak{B}$ was raised to the following extreme values:

In wrought iron	45,350 C.G.S.
In cast iron	31,760 "
In Bessemer steel	39,880 "
In Vickers' tool steel	35 820 "
In Hadfield's manganese steel	14,790 "
In nickel	21,070 "
In cobalt	30,210 "

The induction was measured by means of a coil consisting of a single layer of very fine wire wound upon the central neck of the bobbin. Outside of this coil, at a definite distance from it, a second coil was wound, and the magnetic force was determined in the annular space between the two. In a paper communicated to the Manchester meeting of the British Association, the authors showed that if the force so measured could be proved to have the same value as the magnetic force within the metal neck itself, it would follow that the intensity of magnetism $\mathfrak{I}$ had begun to diminish under the action of excessively strong fields, in the manner which Maxwell's extension of the Weber-Ampère theory of molecular magnets anticipates. In the present paper the authors discuss at some length the question of how far the magnetic force within the metal is fairly measurable by the magnetic force in the ring of surrounding air, and they show that with the form of cones originally used the force within the metal must have been less than the force outside, by an amount probably sufficient to explain the apparent decrease of $\mathfrak{I}$. The form of cone suited to give a uniform field of force with sensibly the same value in the metal neck and round it is investigated; and experiments are described in which the condition necessary for a uniform field was satisfied. The results of these experiments are conclusive in showing that no considerable change takes place in the value of $\mathfrak{I}$ (in wrought iron) when the magnetic force is varied from about 2,000 to 20,000 C. G. S. units. Throughout this range of force the intensity of magnetism has a sensibly constant value of about 1,700 C. G. S. units, which is to be accepted as the saturation value for wrought iron. The term saturation may be properly applied in speaking of the intensity of magnetism, but there appears to be no limit to the degree to which the magnetic induction may be raised.

To produce the greatest concentration of force upon the central neck, the converging pole faces should have the form of cones, with a common vertex in the middle of the neck, and with a semi-vertical angle of 54° 44′. This form, however, does not give a uniform field in the neighborhood of the vertex. To secure that, the condition is that d^2F/dx^2, d^2F/dy^2, and d^2F/dz^2 shall vanish, F being the magnetic force at the vertex, which is due mainly to the free magnetism distributed over the pole faces. The condition for a uniform field is satisfied when the cones have a semi-vertical angle of 39° 14′. When this form is given to the cones, the magnetic force in the air immediately surrounding the central neck may be taken as sensibly equal to the force within the neck, and it therefore becomes practicable to measure the relation of the induction to the force producing it, that is to say, the magnetic permeability.

The greatest attainable concentration may be calculated by assuming the pole faces to be saturated, when the cones are such as to have a maximum concentrative power (semi-vertical angle = 54° 44′). Under these circumstances the magnetic force at the vortex due to free magnetism on the conical faces is:

$$18{,}930 \log_{10} \frac{b}{a},$$

where b is the diameter of the poles at the base of the cones, and a the diameter of the central neck.

The following are probable values in the intensity of

* Abstract of a Paper read before the Royal Society, Thursday, Nov. 22, 1888.

magnetism when saturation is reached in the particular metals examined:

	Saturation value of B
Wrought iron	1,700
Cast iron	1,240
Nickel (with 0.75 per cent. of iron)	515
Nickel (with 0.56 per cent. of iron)	400
Cobalt (with 1.66 per cent. of iron)	1,300

Experiments were also made with specimens of Vickers' tool steel, and other crucible steels, Whitworth's fluid-compressed steel, Bessemer steel, Siemens steel, and Hadfield's manganese steel. This last material, which is noted for its extraordinary impermeability to magnetic induction, was found to have a constant permeability of about 1.4 throughout the range of forces applied to it, namely, from 2,000 to nearly 10,000 C. G. S.

The results are exhibited graphically by curves drawn in Rowland's manner to show the relation of the permeability to the magnetic induction. In the highest field examined the permeability of wrought-iron had fallen to about 2.

Western Union Earnings.

The Western Union Telegraph Company issued on Dec. 12 the statement of its business for the quarter ending Dec. 31, the earnings for the present month, of course, being estimated. The "net revenues" are set down at $1,650,000, an increase of $150,000 over the corresponding period of last year.

There was an increase of $569,188 in the company's surplus at the beginning of the quarter, making revenues at the close of the quarter, including the current three months' revenues, aggregate $9,573,757. The quarter's payments for interest and sinking fund amount to $204,802, an increase of $62.152, the quarter's balance being $9,368,955, a gain of $657,036. The quarter's dividend was increased to $1,077,876, the surplus for the quarter remaining $8,291,578, an increase of $657,003.

Business incident to the Presidential election had much to do with the increase in revenues.

Work of the Subway Board.

At the meeting on the 11th inst. of the Board of Electrical Control, Commissioner Gibbens during a discussion of the application of the Empire Bay State Company to string wires on poles already up from Woodlawn to the Harlem River, remarked that the utmost encouragement should be given to companies that proposed, as in the case in question, to send 24 messages over one wire, 12 at each end, as such a system would materially increase the possibility of doing away with a large number of wires. Mr. Hess stated that he should vote against the application, not that he had any objection to the company running its wires, but he objected to the want of courtesy to the engineer of the Board which the apparently premature putting of the resolution implied. Commissioner Gibbens deprecated any want of courtesy toward the engineer, and the resolution on being put to the vote was passed.

The Mount Morris Electric Light Company applied for permission to erect poles and wires in certain streets in Harlem, but on it being reported that the rules and regulations of the board had not been complied with, the matter was referred to the expert, to be reported on at the next meeting.

The petition of the Ball Electric Illuminating Company to string wires in West Broadway, Hudson street and Seventh avenue was also laid over.

The application of the Brush Electric Light Company to run overhead wires through Gansevoort and Greenwich streets from Gansevoort to Washington Market was granted.

Mechanical Explanation of Electrical Phenomena.

On the evening of Wednesday, Dec. 12, Mr. Leonidas Le C. Hamilton, author of "The Origin of Energy," presented before the Boston Electric Club a mechanical explanation of electro static and magnetic phenomena, illustrated by diagrams and experiments. According to his theory every gas is composed of molecular vortices. The molecules of the gas, rotating about their axes while surrounded with the so-called ether, throw the latter into vortices around each molecule. These vortices, by the laws of mechanics, are compelled to join their poles and rotate in the same direction, thus forming the lines of force with a tangible or real existence. These lines of force ending on the poles of every magnet are all rotating in the same direction as the earth's lines of force, the tufts at the ends of the magnet being, in fact, connected with the earth's lines of force. As the lines of force all rotate in the same direction, it follows that when two similar poles are brought near each other they cause the mutual repulsion. When dissimilar poles are brought opposite, it was shown that lines of force are brought in contact while rotating in *opposite* directions, and the lines coalesce at the point of contact, thus reducing the pressure, and that the poles are thrust towards each other.

It was then pointed out that all the phenomena of electrostatics could be explained by the differences of stress of these lines of force. The effect of heat, which the lecturer pointed out always exists on the negative surface, is to reduce the stress at that point, with a corresponding increased stress at the positive point. The known laws of mechanics were applied to all the phenomena and alleged to explain them all.

Many questions were asked by several members of the club, and were answered by Mr. Hamilton to the apparent satisfaction of those present.

Electric Rents.

The use of electricity is a great inducement leading to the letting of houses, flats, or rooms nowadays. Electric bells have long been introduced; annunciators are following; a telephone for common use is appreciated; the electric light is now a desideratum in good hotels and in flats, and will soon be so in private houses; electric door-openers are coming in; electric motors for lifts, fans, pumps, and knife-cleaners, etc., will follow; electric hoists or trams for supply of coal and manipulation of luggage, or even of breakfasts, are worth consideration; electric heaters, and water boilers, may also yet become as common as gas stoves. These considerations, says the London *Electrical Engineer*, make us think that the servant question is already becoming a solvable problem, and the query, "Is life worth living?", will soon become one of electrical conveniences. The influence of electricity upon the letting power of houses and flats must cause a constantly increasing pressure towards their introduction in all modern buildings.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Dec. 17, 1888.

Eddy Motors, Etc.

Mr. H. C. Willis, of Willis & Hunter, 115 Broadway, representing the Eddy motor, have been quite busy installing the various sizes of that motor—⅓, 1 and 5 h. p., etc.—in their office for exhibition purposes and in outside plants. They are using on their circuit the Paiste snap switch, which you recently illustrated, and of which they speak in the highest terms. They give the Habirshaw wire preference in installations. They have already sold six motors—two of 5 h. p., two of 3 and two of ⅓—in their first week.

Revolving Show Stands.

This is especially the season of the year when tradesmen desire to display their wares to good advantage and to attract a crowd around their windows. Among the popular methods of achieving these purposes are the revolving show stands, run by small motor and two or three cells of battery. Pearce & Jones, of 79 John street, who are well known as the makers of these stands, are busy to their utmost capacity, and find special demand for their octagon stand, with velvet facing and wire hoops, from which to suspend jewelry, fancy goods, hosiery, etc.

Ball Engines for Electric Lighting.

C. R. Vincent & Co., 15 Cortlandt street, have just started two Ball engines of 60 and 80 h. p., respectively, for the Orange, N. J., Excelsior arc light system. They have also put in a 25 h. p. Ball engine at Summit, N. J., for the Excelsior arc and incandescent plant. At Lansford, Pa., they have just started a 60 h. p. complete steam plant, with Ball engine, for another Excelsior arc dynamo. At Albany, N. Y., they are putting in two complete steam plants of 100 h. p. each, with Ball engine, for the Edison Light and Power Company, and they have just delivered a 100 h. p. Ball engine to the Amsterdam, N. Y., Arc Light Company.

C. & C. Motor Company.

The C. & C. Motor Company have just taken a fine new building at 402 and 404 Greenwich street. It is a large fireproof six story structure, and one of the best of its kind in the city. They will run the machinery with their motors, the current being supplied by Edison dynamos and Ball engine in the basement. The company have been compelled to leave their present limited quarters on account of the great increase in their business during the past year. They believe that their new factory will enable them to meet the demand of the trade with greater ease, and to demonstrate a successful solution of some very interesting motor problems. The plant promises to be one of the most perfectly equipped of the kind, if, indeed, there are any like it, in the world.

United States Alternating Plants.

The United States Electric Light Company have just closed a contract for their alternating system of incandescent lighting at Redbank, N. J., to start up with 500 lights. They have also closed a contract for a similar plant of 500 lamps of 16 c. p. at Pottstown, Pa., for the Pottstown Light, Heat and Power Company. Among other United States plants which are now operating on the alternating system may be mentioned those at Winsted, Ct.; Moline, Ill.; Lasalle, Ill.; Rochester, Minn.; Burlington, Ia.; Kankakee, Ill.; Manchester, Ia.; Brazil, Ia.; Clinton, Ia.; Des Moines, Ia.; Manistee, Mich.; Marion, Ind.; Pontiac, Ill., and La Paz, Bolivia. Altogether there are about 25 of these plants, and great claims are made for the efficiency and economy of the system.

Lawrence, L. I.

Mr. F. E. Kinsman, of the Electric Construction and Supply Company, 87 Liberty street, was actively engaged last Friday shipping moldings and supplies for the electric wire and cables to be put up for interior work and underground at Lawrence, L. I., in connection with the 200 16 c. p. incandescent plant lately contracted for by the Gibson Electric Company, who are to furnish the storage batteries. This plant is to be erected on the grounds of Mr. G. C. Rand, the coffee merchant, who puts up a special building for the purpose. It will be one of the handsomest isolated plants in the country, as everything will be of the first order of excellence. It is intended to light Mr. Rand's residence, green houses, stables, etc. The power will be furnished by a Shipman oil engine, and the whole will be stored in order to add to the capacity of the plant when the lights are on. The Gibson Company are also installing a 500-light plant in the dry goods district, this city.

A New Enterprise.

Messrs. H. B. Oakman, formerly of the old Electrical Supply Company, of this city, and the Long Distance Telephone Company, and Mr. G. W. Annable, another old representative of the first-named concern, gave a very successful exhibition about a week ago, in Brooklyn, of their new fire extinguisher. A large number of people witnessed the trial, and saw over 200 square feet of raging flame put out by the apparatus, which is made by the Empire City Manufacturing Company. In this machine no chemicals are exposed or in action until wanted, when two glass vessels are broken inside a nickel tube, which forces out the mixture. The apparatus is very handy, 14 inches high by 5 inches in diameter, and may certainly be highly recommended to telegraph, telephone, electric light, district messenger and other companies.

Personals.

Mr. A. Appleton, lately manager of the Hall Engineering Company, is meeting with large success in this section as the agent for various steam appliances for electric light steam plants. Among these specialties may be mentioned the Reliance gauge, illustrated in THE ELECTRICAL WORLD of Dec. 15; the Reliance automatic re-starting injector; the patent centrifugal exhaust-pipe head; improved rotary pumps, to be run by electric motors; pressure regulators, for keeping the steam uniform on high-speed engines, etc.

I am sorry to note the death, by heart disease, of Mr. C. O. Brewster, who was filling the position of secretary and treasurer of the Telemeter Company.

Mr. C. W. Sutherland, the editor and publisher of the *Safety Valve*, which is issued by the American Steam Boiler Insurance Company, has supplemented a recent issue of his excellent journal by a good portrait of Mr. W. K. Lothrop, the president of the company, and a biographical sketch from the *Insurance Times*.

Exhibition Plants.

The United States Electric Light Company, 120 Broadway, are installing in the basement of that fine building exhibition plants to illustrate the merits of their system. The apparatus shown includes a 375-light 16 c. p. incandescent dynamo, and a 20-light arc machine, which is to run 10 arc lights and incandescents in multiple up to the extent of its capacity. Power is taken from a Porter engine. There is a large board fitted up with 300 16 c. p. lamps with gang switches, to show how any number of lamps can be thrown into or out of circuit according to the will of the operator, and the necessities of the case, without in any way affecting the brilliancy of the other lamps in circuit or the operation of the dynamo. There is also a similar machine to be run by a Baldwin gas engine. A similar plant with Julien storage battery supplement, is now running very successfully in the basement of the Potter building, furnishing a number of 32 c. p. lights for the main hall, and a large number of 16 c. p. lights for the headquarters of the Otis elevator people. The exhibition plants above mentioned include fixtures illustrative of the latest designs, as well as the Underwood cotton leather belts, for which Mr. A. B. Lawrence is the agent.

Sale of Ball Electric Light Plants.

Among their late sales the Ball Electric Light Co. of this city report the following: Wilmington City Electric Co., Wilmington, Del., an increase of 75 arc lights; American Electric Light Co., of Kansas City, Mo., an increase of 75 arc lights. Each of these companies purchased of them before a K., 75-light, 2,000 c. p., arc dynamo complete, and increase as above with a second dynamo of the same size. This dynamo appears to be attracting special attention for street and commercial lighting. It is the largest dynamo yet manufactured by any company in the world, and at the same time the h. p. required at the pulley is but 52.5, and it occupies less floor space than most dynamos carrying but 35 lights. Like all other dynamos of their system it requires no foundation whatever, but is simply fastened lightly with wooden blocks to the floor. In addition to these they report the following: Phœnix Woolen Co., East Greenwich, R. I.; Stoughton Lighting Co., Stoughton, Mass.; Kirksville Light, Heat, Power & Water Co., Kirksville, Mo.; Stetson & Post Milling Co., Seattle, W. T.; Edison Electric Ill. Co., of Hazleton, Pa.; Newport Light Co., Newport, Ky.; C. S. Bradford, West Chester, Pa.; Walworth Steam & Power Co., Boston, Mass.; West Coast Electric Light & Construction Co., San Francisco, Cal.; or a total of about 600 arc lights.

The Julien Cars on Fourth Avenue.

Mr. William Bracken, the managing director of the Julien Electric Traction Company, reports as follows in regard to the Fourth Avenue cars: "It had been our hope by our new method of regulation to so economize the use of the current from our battery as to make three round trips, or 36 miles, with one charge of battery on the Fourth and Madison avenue lines. I now take pleasure in informing you that we have accomplished that result, and that our large 18-foot cars, carrying unusually heavy loads of passengers, are now making three round trips from Eighty-sixth street to the post-office and back, or 36 miles, without any change of battery; so that now we change the battery but once a day, thus making a great saving in time. When you consider the long steep grades on Madison avenue, and the number of very sharp curves throughout the line, you may imagine how much farther one of our cars will run on a more favorable surface. But we do not intend to end here, as we now hope to be enabled to make a fourth trip, or 48 miles, on one change, for the reason that at the end of our third trip now we find the voltage of the battery is still above 2 volts per cell. When the battery is fully charged the voltage stands at about 320 (144 cells). At the end of the third trip the voltage is still 300, and the car acts with as much force and life as it did on its first trip. We now go from 86th street to the post office and back, 12 miles, on an expenditure of less than 15 electrical h. p. hours. Therefore we make the 36 miles on 45 electrical h. p. hours. Calculating the cost to be 2 cents per h. p. hour, you will perceive that it costs but 30 cents for energy for a round trip of 12 miles, or 2½ cents per mile. Assuming 75 miles for a car day, the cost would be $1.87. These data are taken from our books at our electric station—which books are open for your inspection. They indicate the ampère hours and the h. p. hours put

into the battery each day, and the cost of the same. But this is by no means the limit of economy which we hope to reach, for we are now having manufactured a motor far more efficient than those at present in use. Our new cars will be at least two tons lighter than those at present running, so that with these two advantages in our favor it is reasonable to hope that we shall reach still greater economy." W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
178 Devonshire Street, Boston, Dec. 17, 1888.

The Dedham Electric Company.

This company has been incorporated with a capital stock of $250,000. The officers of the company are: Mr. John R. Bullard, president, and Mr. Ferdinand F. Favor, treasurer.

A New Electric Bell.

The Electric Gas Lighting Company, of Boston, have recently brought out a new iron box bell, the "Climax," which is very neat in appearance and thoroughly well made in every way, with double adjustment, etc. They anticipate a very large sale for it. The "Hub" iron box bell is still one of their popular specialties also.

Accumulators in Providence.

The New York Accumulator Company has furnished storage batteries having a capacity of 200 incandescent lights in the Swarts Building, Providence, R. I. This building will be wired also for telephone service, messenger calls, thermostats and electric time. The wiring and construction work of the entire installation is by the Providence Electric Company, Mr. C. G. A. Peterson, manager.

Belt Controllers for Dynamos.

The American Tool and Machine Company, of Boston, has furnished the sugar refinery of Harrison, Frazier & Co., Philadelphia, with six dynamo belt controllers; also one to Carter & Rogers, at Lebanon, N. H., and another to the City Manufacturing Corporation, at New Bedford, Mass. These belt controllers are attached to the dynamos in the isolated electric light plants of each of the above named concerns. The American Machine & Tool Company is selling a good many of these dynamo belt controllers.

Handsome Calendars.

Messrs. Houghton, Mifflin & Co., Boston, Mass., the well-known publishers of the Riverside Press and *Atlantic Monthly*, are following their usual annual custom of furnishing the trade with brilliantly illuminated calendars. In addition to a reproduction of the attractive "Poet Calendars" published in years past, including Longfellow, Holmes, Whittier, Bryant, there is a new style for this year, which is still more artistic in its design and more rich in its coloring than any of the others. It represents a group of the more prominent poets.

Electric Fire Protection.

The American Fire Alarm Company, Boston, Mass., will install its system of automatic fire protection throughout the new steamer "Puritan," now building for the Fall River Line. This steamer will be a model of elegance, safety and comfort. Nearly 500 thermostats will be required, and with this protection in every part it will be impossible for a fire to get any headway before the officers and crew are notified. The steamer "Bristol" is already equipped with this system. This fire-alarm company is doing a large business throughout New England fitting up manufactories and storehouses with this protection, and large rebates in rate of insurance are being allowed therefor.

Personal.

General C. H. Barney, of New York, the Auditor of the Sawyer-Man Electric Company, has been spending a few days in Boston.

Mr. R. E. Gallaher, of New York, secretary of the New York Insulated Wire Company, enjoyed a short business visit to this section last week.

Mr. J. M. Orford, the superintendent of the Bridgeport Electric Light Company, favored this office with a visit last Thursday.

Mr. H. E. Duncan, of the American Waltham Watch Company, will give a lecture, illustrated with apparatus, on Non-Magnetic Watches at the rooms of the Boston Electric Club, on Wednesday evening, Dec. 19.

Halifax, N. S.

Mr. Fred. S. Pearson, of the Somerville Electric Light Company, who has been devoting considerable attention of late to the development of the business of the Chandler Electric Company, of Halifax, has been investigating the best systems of fuel and illuminating gas with a view of adding an equipment to the business of the Chandler Company, whose franchise covers the privilege of operating gas as well as electricity, and the low price at which gas can be produced under the new systems would seem to insure a success in that city in connection with the large and growing business of the company. He also reports that the new orders of the company necessitate the adding of a new boiler of 125 h. p. and two new engines of 100 h. p. each, which have been ordered and will be installed within the shortest possible time. The present system of arc lighting is said not to have proven fully satisfactory, and it is being replaced by one of the best which can be procured.

Lighting Engines for the Navy.

The recent report of Lieut.-Com. R. B. Bradford, U. S. N., Naval Inspector of Electric Lighting, to the Chief of the Bureau of Navigation, a review of which recently appeared in your columns, brings out the interesting fact, it appears, that the Armington & Sims Engine Company have now, practically, a monopoly of the electric lighting work in the navy. The engine appears to have been found so thoroughly satisfactory that no other is wanted. The "Omaha," "New Hampshire," "Dolphin," "Atlanta," Boston," "Chicago," "Trenton" and "Yorktown" all have Armington & Sims engine equipment, and the "Baltimore" and "Pensacola" will have similar installations. Lieut.-Com. Bradford mentions the fact that the engine on board the "Trenton," whose plant was installed as far back as 1883, has run continuously for fifteen days. It must be admitted that these facts speak volumes for the excellence and efficiency of the work turned out by the well-known Providence firm.

Fitchburg Engines.

The Fitchburg Steam Engine Company report that the contract for the electric light plant for Leominster was awarded to them some weeks ago, and they are now at work putting in the engine, etc., and expect to have the plant in operation now very soon. They are at present having a very large business in fitting up complete electric light plants all over the country. They are putting in a plant at Orange, Mass., this being the duplicate of a plant they started there six months ago; also a complete plant for the Stoughton, Mass., Electric Light and Power Company. They have just started 200 h. p. for the Lynn, Mass., Electric Light Company; two 90 h. p. engines for the Brush Light Company, in Boston; 85 h. p. for Hathaway Building, Boston; 180 h. p. for Houghton & Dutton's electric light plant in their new building on Tremont street, Boston. They have also just started the electric light plant for Whitten, Burdett & Young in their new building, corner Washington and Kneeland streets, Boston; also 85 h. p. for the Continental Clothing Company, corner Boylston and Washington streets, Boston; 75 h. p. for Cobb, Aldrich & Co., Washington street, Boston, for running electric lights, and a complete plant in Gardner, Mass. They have many others in all parts of the country.

Thomson-Houston Plants.

The Thomson-Houston Company have recently sold the Standard Light and Power Company, Montpelier, Vt., one 45-light arc dynamo; Canastota Electric Light and Power Company, Canastota, Ia., one 500-light alternating current dynamo; Lehigh Valley Railway Company, Southeastern Pennsylvania, one 50-light arc dynamo; Georgia Electric Light Company, Atlanta, Ga., three 50-light arc dynamos; Hartford Electric Light Company, Hartford, Conn., one 1,000-light alternating current dynamo; No. Attleboro Steam and Electric Company, No. Attleboro, Mass., one 40-light arc dynamo; New Bedford Gas Light Company, New Bedford, Mass., two 50-light arc dynamos; San Antonio Thomson-Houston Electric Company, San Antonio, Texas, one 1,000-light alternating current dynamo; Framingham Electric Company, So. Framingham, Mass., one 500-light alternating current dynamo; Charleston Light and Power Company, Charleston, S. C., one 500-light alternating current dynamo; Paterson Electric Light Company, Paterson, N. J., four 400-light incandescent, one 50 and one 45-light arc dynamos; Concord Electric Light Company, Concord, N. H., one 50-light arc dynamo; at Hillsboro, O., two 35-light arc dynamos; Union City, Ind., one 35-light arc dynamo.

The Boston Electric Club Entertained.

On Wednesday, Dec. 12, the American Waltham Watch Company entertained nearly fifty members of the Boston Electric Club, at the factory of the former, in Waltham, Mass. The object of the trip was to inspect the non-magnetic watch departments, and to visit the large and finely equipped isolated electric light plant.

Through the courtesy of Treasurer Royal E. Robbins, the members of the Electric Club were shown through the departments of the factory referred to by Messrs. H. E. Duncan, E. A. Marsh and D. W. Eldredge. These gentlemen took special pains explaining every detail in the construction of their company's non-magnetic watch, and satisfied their guests that this product stands second to no other in the world in withstanding all magnetic influences and in keeping accurate time.

After the trip through the watch departments, dynamo and engine rooms, the party were escorted to one of the spacious offices, where a collation had been spread. The president of the company, Mr. E. C. Fitch, here greeted the guests and extended them welcome to the Waltham Watch factory; and requested all to partake of refreshments. While the good things were being digested, Treasurer Robbins addressed the members of the Boston Electric Club in a happy vein, in which he reviewed many of his experiences during the long period he has been connected with this great watch manufacturing enterprise. He finished his remarks by cordially inviting those present to visit the factory again whenever they could conveniently do so. Messrs. Rice, Cram, Ridlon and others made appropriate speeches.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Dec. 17, 1888.

Lighting a Church.

Tabernacle Baptist Church, Chestnut street above Eighteenth, which is undergoing repairs, will be the first house of worship in Philadelphia to be illuminated by electricity. Over 200 incandescent lamps are now being put in the building, and they will be lighted for the first Sunday in January.

Oil Cups.

J. E. Lonergan & Co., of 211 Race street, manufacturers of patent oil cups and safety steam appliances, have issued a handsome illustrated price list and catalogue of their goods. The new list makes a volume of 50 pages, and, besides having profuse illustrations, it is elegantly bound in imitation alligator skin.

New Lights and Conduits.

At the last meeting of Councils, ordinances were passed authorizing the removal of the Siemens gas lamps from the public squares and the substitution of electric lights therefor; and authorizing the American District Telegraph Company to lay conduits on the west side of Fifty-second street north of Lancaster avenue.

Big Electric Light Belting.

Charles A. Schieren & Co., 226 North Third street, have on exhibition in their store what is said to be the largest piece of belting ever made, it being no less than 57 inches wide and over 100 feet long. It is intended for use in connection with an electric light plant. It is an excellent piece of work. Schieren & Co. occupy the entire building where they are now located, and it is thoroughly adapted to the uses they make of it.

Haverford College, Pa.

An execution was issued in Norristown Saturday last against the Haverford Electric Light Company for a judgment of the Philadelphia Electro-Dynamic Company for $20,211.86, dated Oct. 5, 1888. The station of the Haverford Company was recently destroyed by fire, and the issuance of this execution is said to be merely a formal proceeding for the protection of the Electro-Dynamic Company, who are one of the largest creditors.

Lighting Railroad Tracks.

A dispatch from Reading says: "To lessen the number of accidents in this city, the Philadelphia & Reading Railroad Company are about to illuminate one mile of their tracks, from Walnut street northward, with arc electric lights. About thirty lights will be placed at proper distances apart, which will greatly facilitate the making up of trains for the main line and branch roads. Several thousand cars are handled by the company in this city every night.

Scranton, Pa.

A dispatch from Scranton, Pa., says: The People's Railway Company inaugurated its electric system last Wednesday by starting cars on the Dunmore line. The plant worked successfully, the electric current carrying the cars up the heavy grades with ease. Thursday the Green Ridge line was opened, and on succeeding days the Providence and Hyde Park systems were started, making in all eight street railway lines in Scranton operated by electricity and dispensing entirely with the use of horses. The electric railways of Scranton are now the most extensive in the world, and almost 25 miles in length, with the systems now in operation being largely extended.

Small Metal Tubing.

The Spring Garden Metal Works, of 528 North Tenth street, who are manufacturers of every description of round, square and pressed metals, are making a specialty of small metal tubing. At their works last week I saw samples of tubing from ⅛ inch in diameter down to the size of a cambric needle, made of all kinds of metal and of every conceivable shape, such as square, round, oval, etc. They do a large business in the line of seamless tubing of small sizes, and also in stamped ware, such as is used on gas and electric burners.

The Keystone Works.

The Keystone Engine and Machine Works, Fifth and Buttonwood streets, while an old establishment, are comparatively a recent acquisition to the electrical field. They are manufacturers of a number of engineering specialties, such as centrifugal steam separators, centrifugal exhaust heads, Keystone double plunger belt pumps, and Keystone feed-water heaters and purifiers. The heater and purifier of this house is very highly spoken of. Mr. William L. Simpson, a machinist and engineer of large experience, operates the Keystone works, and most of the specialties turned out are covered by his own patents.

Consolidated Electric Light Stock.

Walter Wood and Stuart Wood, of this city, have secured judgment in the United States Circuit Court in New York for $18,550 against the Consolidated Electric Light Company, being the principal and interest on $17,500 worth of bonds held in the defendant company. The complaint was that interest had not been paid. When judgment was entered the company answered that forged and fraudulent bonds had been issued, and that to secure bondholders a new issue had been made exchangeable for the original bonds, and that the complainants had not exchanged their bonds. The complainants entered a demurrer to the sufficiency of the answer, and were supported by Judge Wallace.

The New Harrison Boiler Headquarters.

New Harrison office quarters have been erected this fall at the eastern end of the works, at Germantown Junction. They have a brick building, 35 feet by 40 feet, divided into private rooms, general office and drawing room, all thoroughly well lighted by large windows, and well ventilated by a shaft running up the centre of the building with openings into every room, and heated by steam from a 4 h. p. "Junior" type Harrison safety boiler in the cellar. An off-set from the main building contains two fireproof vaults, the entrance to one of which is from the main office and to the other from the drawing room. They have been running very steadily all this year, and now have a number of orders on hand, several of which are from old customers, who have had their boilers in use for 20 years. E. W. E.

PENNSYLVANIA NOTES.

BEAVER FALLS, Pa., Dec. 12, 1888.

On Monday evening the Beaver Valley Electric Light and Power Company started its plant of 750 lights of the Westinghouse incandescent system, and everything went off to perfect satisfaction. The dynamo is driven by a water wheel which can generate on call 300 h. p. Outside of the fact that some of the "hayseeds" were rather disappointed because each 16 c. p. light did not show up with a full capacity of 2,000 c. p., very much pleasure and admiration was expressed by the citizens. The company expect to put in an arc machine very soon, and light up New Brighton and Beaver, a distance of four miles, with both arc and incandescent lights. The Westinghouse Company have secured the contract to light up the whole of Pitts, Pa., and have another contract for a 750-light alternating machine for Washington, Pa.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Dec. 15, 1888.

Joplin, Mo.

O. R. Moffitt is increasing his plant by the addition of 50 Thomson-Houston arc lights.

Ft. Atkinson, Wis.

Cornish, Curtis, Green & Co., of this city, have just purchased a small incandescent plant of the Thomson-Houston system.

Marshalltown, Ia.

Mr. T. L. Seevers has just increased his plant by the addition of 30 arc lights and 1,000 incandescent, both of the Thomson-Houston system.

A New Agency.

The Electrical Supply Company have secured the Western agency for the Sawyer-Man Electric Company, of New York. The company will carry in stock a full line of that company's well-known goods, consisting of lamps, sockets, etc. This af

rangement will be of much advantage to users in the West. It goes without saying that the company will push the sales of these goods in their usual energetic way.

Akron, Ohio.

The Webster, Camp & Lane Company, of this city, have just purchased, through the Western Department of the Thomson-Houston Company, a plant of 200 incandescent lamps.

Personal.

Mr. David Chamlers, of the Empire City Electric Company of New York, was in the city a short time this week, and favored the Western office of THE ELECTRICAL WORLD with a pleasant call.

Edison Plants.

The Western Engineering and Electrical Company of Kansas, Chetopa, Kan., have just finished installing Edison plants in the Alles Flour Mill, at Fort Worth, Texas, and the Emma Cotton Seed Oil Mill, at Pine Bluff, Arkansas.

New Electric Railway Corporation.

An incorporation license has been granted by the Secretary of State to the American Electric Railroad Company, located at Chicago; capital stock is $1,000,000. Incorporators: Hugh Henry, H. Edgell and Stephen H. Emmens.

Telegraphers' Ball.

Chicago Division No. 42, of the Railway Telegraphers of North America, gave a ball at Martine's Academy on Thursday night of this week. A merry time was indulged in by the jolly dancers, and the affair was pronounced a great success.

Telephone Matters

In the City Council last Monday night an ordinance was presented by Alderman Rex on behalf of the Judiciary Committee, directing the Commissioner of Public Works to refuse to grant a permit to the Bell Telephone Company to exercise further privilege in this city until otherwise directed by the Council. The passage of the order was moved and the motion adopted.

New Baxter Agency.

Mr. W. W. Munroe, Western manager of the Baxter Company, has just assigned to Leeds & Barrett, of St. Paul, the agency for the Baxter motor in that section. Messrs. Leeds & Barrett are dealers in general electrical supplies, having offices in St. Paul, Minneapolis and Chicago. The firm will push the motor part of the business, employing their own expert for making new installations, tests, etc.

To Extend the City Plant.

It is reported that Commissioner Swift has instructed City Electrician Barrett to draw up an estimate of the cost of lighting Milwaukee avenue from Halsted to North avenue, with electricity. There will be an unexpended balance to the credit of the Department of Public Works at the close of the year, and if the Council concur the city electric lighting system will be extended to N. Clark street.

Telephone Quotations.

Col. S. G. Lynch, broker, 146 La Salle street, furnishes quotations upon telephone stock as follows:

Bell of Mo.	$149@$152	Iowa Union	$23@ $25
Central Union	46@ 47	Michigan	80@ 81
Chicago	325@ 330	Missouri and Kansas	69@ 70
Colorado	40@ 41	Rocky Mountain Bell	39@ 40
Cumberland	65@ 68	Wisconsin	115@ 117
Great Southern	30@ 35		

The Mather Electric Motor.

Mr. J. H. Reid, manager of the Western department of the Mather Electric Company, is kept quite busy with new installations. He informs me that the new plant at Neenah, Wis., has just started up. The work of wiring the new plant for lighting the *Pioneer Press* building of St. Paul will be commenced about Jan. 1. The installation will consist of some 2,400 lights and will reflect much credit on Mr. Reid and the Mather Company. I also learn that the Cincinnati representative of the company, W. N. Gray, is unusually busy just now in installing plants in Cincinnati and vicinity.

The Van Depoele Company.

The Van Depoele Company have just sold a 200 incandescent light plant of their new system to Bradner, Smith & Co., of this city, for lighting their mill at Rockton, Ill. Graham & Co., of Rock Island, Ill., have also purchased an incandescent plant of the same system. At the offices and shops of the company several improvements have been inaugurated. Among these I may mention lighting by means of over one hundred incandescent lights, which number will be increased. The light produced is clear and steady and evidences the efficiency of the system. About 40 arc lights are also employed in lighting the factory.

The Wichita Electric Railway.

Mr. T. P. Bailey, of the Railway Department of the Thomson-Houston Company, in conversation a few days ago, said to me: "Our Wichita road is a complete success." In corroboration of this he showed me a letter from the Riverside Suburban Railway, from which I make the following extract: "Our road has now been in operation under your system for the past four weeks. The trial trip was an immense success, as evidenced by our daily papers. Regular trips were then commenced, which have since continued. We are especially pleased with its operation. As long as we get as efficient service as we now have (and we know of no reason to the contrary) we shall consider that we have the best system of street motive power in existence to-day. We think it excels the cable in every feature."

New Installation Completed.

The installation of the Merchants Light and Power Company's new plant, 327 Dearborn street, has just been completed and the lights turned on. The system used is that called the "Improved Sperry," manufactured by the Sperry Electric Company. The capacity of the plant is 240 lights, of which number 80 are now in operation. The remaining 160 lights will, I learn, be added as soon as possible. The dynamos, of which there are four in number, each of 20-light capacity, are driven by a 145 h. p. New York Safety Engine, the fly-wheels of which are connected with the dynamos by means of the Ireson link belt, each wheel running two belts. I may say that each dynamo has an automatic regulator, which controls the lights perfectly. The light produced is clear and steady and is in every way satisfactory to the company. The circuits are all underground, Okonite wire being used throughout. The engine and dynamos are running as smoothly as possible, the installation, on the whole, reflecting much credit upon the Sperry people.

Elgin, Ill.

A special from Elgin, Ill., dated Dec. 7, states that after an exciting session of the City Council the contract for a complete electric lighting outfit was awarded to the Jenney Electric Light Company, of Indianapolis, for $15,525. Mayor Price may veto the proposition, but the award will probably be carried over the veto. Five years ago the Elgin Electric Light Company constructed a Van Depoele plant, including eight towers. A contract was made for five years at an annual rental of $8,000. This contract expired Nov. 7, and at a meeting of the Council held two months ago it was decided that the city should purchase a plant and operate it. An appropriation of $16,000 was passed for that purpose, and various companies were invited to compete. A lively fight ensued. Elgin offers exceptional facilities for an exhibition plant, and no less than fourteen companies sent bids. They ranged from $13,000 to $22,000, and each company had energetic representatives on the ground. For the last two weeks the air has been full of rumors alleging fraud and corruption. The Council has spent a large portion of its time traveling from one city to another, examining various systems. To-night the fight came to a head, and the contract was let by a vote of 10 to 3, after a session remarkable for the number of times the lie was passed without bloodshed resulting.

Riley Railway Construction Company.

This company has moved into larger and more commodious quarters on the fourth floor of No. 95 Milk street, Boston, and the officers, president, F. A. Bartholomew; treasurer, E. F. Ferrand, and manager, F. E. Clark, will be pleased to see their electrical friends and exhibit to them the models of the "Riley" system. *Apropos* to the above I have clipped from a recent issue of the Boston *Traveller* the following:

"A project that looks a great deal like business is now on foot to establish an elevated railway line from the northern depots to Franklin Park and City Point. A petition to the Massachusetts General Court has been prepared, praying for the incorporation of 'Frank A. Bartholomew, Joseph Bennett and their associates, under the name and title of the Boston Elevated Railway Company, with the power to build and operate elevated railways in Boston, starting at or near the Boston & Lowell railroad station, via the Eastern railroad station, the Fitchburg railroad station, Commercial street, Atlantic avenue, the New York & New England railroad station, the Boston & Albany railroad station, the Old Colony railroad station, and thence by the most feasible route to some point at or near Franklin Park in West Roxbury; and also from some point at or near the corner of Kneeland street and Federal street to some point at or near City Point in South Boston, with one or more branches from the main line to the centre of the city.' The signs of the times point to an enthusiastic public support of such a project, and it is not rash to predict its speedy success."

The Tel-Autograph.

The Sunday *Tribune* says that from his workshop in Highland Park Prof. Elisha Gray is at last able to lay on the desk of his correspondent in Milwaukee a fac-simile of whatever he puts on paper at this end of the wire. The finishing touches to the tel-autograph will be made within the next two weeks. A head company has been formed in New York and subordinate companies are organizing over the country to put the invention in use. "The instrument now reproduces each stroke of the pen or pencil with almost exact fidelity," said Professor Gray to a *Tribune* reporter. "The repronuction is just up to the point of not being the original. The difference is enough to prevent long-distance forgery. At the same time the copy at the other end is so nearly like what you write that for all ordinary purposes it is your handwriting." Several specimens of copy, when compared with the original, showed a slight waviness of line as the only distinction. One could come much nearer telling the reproduction of a friend's voice by the perfected phonograph from the voice itself than he could a tel-autographic copy of the same friend's handwriting from his true fist. "I expect the invention," continued Prof. Gray, "at once to supersede the telephone where accuracy is required and over long distances. It will also be taken up immediately as an adjunct to the telegraph in the transmission of messages involving monetary transactions. It can make no mistakes. It tells at the other end just what you write, word for word and line for line. No operators or third parties intervene as interpreters between the two pieces of paper. They stand as fac-simile records, in the hands of transmitter and receiver, of what has passed between the parties."

Proposed Extension of the City Plant.

It is reported that members of the Finance Committee have requested City Electrician Barrett to submit estimates for the extending of the city's electric light plant in all three divisions of the city. It is the intention to operate an independent plant from the North Side Water-Works which will illuminate Clark street to North avenue, North avenue west for some blocks, Wells street from Division street to the river, Chicago avenue from Wells street to the lake, State street south of Division, and one of the residence streets. In the South Side it is the intention to extend the electric lights on Wabash avenue as far as Twenty-second street; on State street to Twelfth, crossing the river to Blue Island avenue, north on Blue Island avenue to Harrison street and east on Harrison street to connect with State street on the South Side.

The estimates of this work, with such off-shoots as Councilmen may suggest, will be about $35,000. Some of the Aldermen seem to think that the appropriation for this purpose ought to be $100,000. When the new lights are in operation on Madison street, Clark street, Michigan avenue and Van Buren street, the Aldermen will be better able to appreciate the advantages of electric illumination, and their appropriation will be governed accordingly. Mayor Roche has proposed to Professor Barrett that the plant now used in lighting the river as far south as Twelfth street be taken out as soon as the new street plant, which will also furnish downtown lights, is in operation; that this old plant be transferred to the Southwest Side and operated from the Southwes Water-Works for the illumination of the river as far as Main street or beyond to Twelfth street. Professor Barrett says the Mayor's plan can be carried out with little cost.

The Western Union Brings Suit.

The following comes from Omaha under date of Dec. 10 James M. Woolworth, solicitor for the Western Union Telegraph Company, this morning filed suit in equity before the United States Circuit Court against the Union Pacific Railway Company to prevent the cancelling of the contract existing between the two companies, by which the telegraph company operates telegraph lines exclusively along the defendant's road. The petition contains 155 specifications. Among other things it recites that in 1860 the Western Union, in connection with the Pacific Telegraph and the California State Telegraph companies, constructed lines between Omaha and Salt Lake.

Subsequently the Western Union, by consolidation with other companies, was invested with sole right to operate these lines, and was further authorized by act of Congress to extend its lines along the track of the Union Pacific as fast as it should be constructed. In September, 1869, the Union Pacific, becoming dissatisfied with the joint use of the system, leased its lines to the plaintiff, bu afterwards under a plea that such an act was not justified by its charter, took the leased lines into its own hands. Plaintiff states that it has reason to believe that the Union Pacific is contemplating further acts in derogation of this lease, including a seizure of the lines between Omaha, Ogden, Kansas City and Denver. A Union Pacific official, when asked about the suit, said: "The act passed in Congress last August requires the Union Pacific to operate its own lines, and it will be done. Of course it will annul the prior contract so far as the subsidized portion of the road is considered, but that is a matter for the courts to decide, and the Union Pacific proposes to abide by the law." The case will be called at Leavenworth, Dec. 27.

Sioux City, Ia.

The business of the Sioux City Foundry and Machine Works is rapidly improving and the prospects for the winter's trade are very flattering. Among the recent sales which they have made I note two of their 75 h. p. Corliss engines for the *Pioneer Press* building at St. Paul, Minn., and two 75 h. p. Corliss engines sold for electric lighting purposes, one of which goes to James Bell, David City, Neb., and the other to the Storm Lake Electric Lighting Co., Storm Lake, Ia. The first of the new line of sizes, a 10 by 16, of Giddings' single valve automatic engines, was sold some time since together with a boiler to go to the Chillicothe Water, Gas and Electric Light Co., Chillicothe, Mo. This will be tested at the works and forwarded to its destination at once. They have also a large force of pattern makers at work, bringing out a full line of sizes of this justly popular engine, which is known at the East as the "Russell" automatic, and which is enjoying such a trade that it is difficult for the original builders to keep up with their orders. In addition to this the Sioux City Engine Works have recently sold several large boiler plants, together with a number of combined outfits to the Erie Engine Works, manufactured by Cleveland & Hardwick, of Erie, Pa., for which they are Western agents. They are still very busy in improving their works, and are putting in at present a ninety inch fly wheel lathe, also an overhead travelling crane, 30 foot span and 7 tons capacity. Their foundry department is driven to its utmost capacity, being obliged to work evenings in order to get out the engine work in addition to the large amounts of architectural iron work, which is required by the rapidly growing country surrounding them. They also report several sales for the Miller duplex steam pumps for boiler feeding. This pump is rapidly growing in favor in their section of the country. During the past two weeks they received quite a number of inquiries from parties asking bids on both the Corliss and high speed type of engines, and they have every reason to believe that they will enjoy a good winter's trade.

E. L. P.

KANSAS CITY, MO., Dec. 15, 1888.

Issue of New Stock.

The stockholders of the Kansas City, Mo., Electric Light Company will vote, Dec. 17, on a proposition to issue bonds for $100,000, payable in ten years, bearing 6 per cent. interest, the money to be used for improvements. There is little doubt the bonds will be voted.

The Coming Edison Convention.

The Edison Convention, which will be held here, will be one of the best, or Mr. E. R. Weeks, who has charge of the local preparations, will fall considerably short of his intentions. Mr. E. H. Johnson, Mr. J. H. Vail and other prominent Edisonians will be present, and perhaps the "wizard" himself will take a trip out west.

More Arc Lighting.

A recent purchase has been made by W. B. Grimes, President of the Kansas City Electric Light Company, of two lots of fifty foot frontage adjoining the plant of the company at Eighth and Santa Fe street. This purchase was made for the company and will be utilized for an addition to the plant. Work will not probably begin before next spring, if that early, and no plans have been prepared yet. But if the company's business grows as steadily in the future as it has heretofore the addition will be a necessity by spring.

The New Edison Station.

The completion of the new building for the Edison plant of the Kansas City Electric Light Company is being greatly delayed. All the contracts were let with the understanding that everything was to be completed and the plant in running order by Nov. 15. Here it is December. The delay is blamable upon nearly all of the contractors, but especially upon the iron contractors. They accept a large share of the censure, but assert that they are helpless; that the iron beam and other iron structural work is controlled by monopolies and "corners," and that contractors obtain the iron just as soon as the "corner" pleases. In this connection it is asserted that the iron monopoly has forced the prices up so high that iron can be bought in Germany with

the cost of transportation added for less than the price of American iron.

The Kansas City Electric Light Company, and especially Mr. E. R. Weeks, the superintendent, are greatly worried by the delay. The Edison Electric Light Convention will be held here beginning on Feb. 12, 1889, and it was greatly desired that the Edison plant should be in operation by that time, not only as a matter of local pride on the part of the local Edison electricians, but for the benefit and entertainment of the visitors, for it is intended to make this plant one of the neatest and completest of its size in the country.

Telephony.

The Kansas & Missouri Telephone Company has completed its metallic circuit between Kansas City, Mo., and Topeka, Kan., a distance of 70 miles. One hundred and forty miles of No. 12 standard gauge copper wire was used. This line makes the third circuit between these two cities, and all are working successfully. In this city the company has just recently finished putting up 10,000 feet of cable and has 11,000 feet on the way which will be strung immediately upon its arrival. The company reports 2,499 subscribers. Superintendent Smith is in doubt as to whether the 2,500th subscriber will be a mascot or a hoodoo. He thinks there is luck in odd numbers especially when the figures are of that high denomination. There is still talk about reducing the telephone rates by city ordinance, but nothing will be done until the Supreme Court of the State passes upon the St. Louis case, involving the legality of such ordinances.

Across the River.

Kansas City, Kan., just across the river, is a consolidated city, and lies straggled along the river's bank for several miles; and yet has not a population of 20,000. The towns in the collection were formerly known as Kansas City, Kan.; Wyandotte, Armstrong, Armourdale and West Kansas. Being so straggled, little effort was made by the Kansas City, Mo., Electric Light Company to extend its system in that direction. Poles were erected and wires strung for twenty or thirty lights, but that was all. Before the consolidation, an independent company in any of the towns was not thought of. Since the consolidation it was thought of considerably, but no more was done toward forming one until last Winter. When the council took the matter up in earnest, Mr. Ben. Friedberg won the fight as well as the franchise. With the franchise he secured a contract for lighting the city that assured profit to the enterprise from the start. He then organized a company with a capital stock of $100,000, with J. D. Wilson, of the First National Bank, as president; Mark Harris as vice president; Benjamin Schmirle as secretary; F. C. Hutchins as attorney, and Benjamin Friedberg as business manager and treasurer. Not one in the company knew the first principle of electricity as a science or a business. The necessity for an electrical manager being obvious Mr. Friedburg crossed the river and secured the services of Mr. Charles Grover, who had been representing the Hawkeye Electric Light Manufacturing Company, of Oskaloosa, Ia., in this city. Mr. Grover made a trip East investigating, and upon his return specifications were sent out, bids received and contracts let. The Hamilton-Corliss Engine Company, of Hamilton, O., furnishes a 250 horse-power engine; Babcock & Wilcox, of New York, furnish a bank of three boilers, each of 92 horse-power, making a total boiler capacity of 276 horse-power. The Electrical Supply Company, represented here by Charles H. Cone, furnishes the wires and other supplies. The Hawkeye Company furnish the electric machinery, including six 25 light dynamos and 150 arc lamps. The erection of buildings, pole-line and wiring is now under way, and Superintendent Grover states that the plant will be pushed to completion rapidly.

But the new company does not meet sunny skies and quiet seas, as it already has a pole line dispute with the old Missouri company.

The "Loop" Question.

One of Kansas City's most veteran "chestnuts" in the line of public questions is the "loop" question. The Tenth street, Eighteenth street, Ninth street, Eighth street and Fifth street cable railways and the Sixth street horse railway either cross or end in Delaware street at or between Fifth street and Ninth street. At Ninth street, Delaware forms a junction with Main street, while at Fifth it is separated from Main by only a short block. The "loop" is Main street from the "Junction" to Fifth, Fifth to Delaware, and Delaware back to the Junction. The Metropolitan Company operates the Eighteenth, Sixth and Fifth street railways, while it has a franchise along Delaware from Fifth to Ninth, and operates a horse car line that distance connecting its Fifth and Eighteenth street lines. Now it is proposed to build a "loop" railway of some kind to connect all these railways, thus virtually consolidating all the railroads in Kansas City. The question is, who shall build it and control? All the railway companies and many people beside are anxious to assume the responsibility, but they are distrustful of each other and the public is distrustful of them, while the Metropolitan Company holds the key to the question by its possession of the Delaware street franchise. In the meantime, however, W. B. Grimes, president of the Kansas City (Mo.) Electric Light Company, has made a proposition which seems to be in a fair way to settle the question. He proposes an independent company and an electric railway. The latter is looked upon with favor on account of its simplicity and economy. The Metropolitan Company favors an electric railway. Mr. Grimes has already received an offer from Eastern capitalists to build and equip and operate the road under any conditions simply as an advertisement of the style of electric railway in whose introduction they are deeply interested. Another electrical railway project is that of the Armourdale line of the Metropolitan Company. The road's motive power at present is the mule. But a franchise for an electric railway has been granted the Metropolitan company, and the company has granted the contract for its construction to the Thomson-Houston Company through its Kansas City agency. This agency, of which Mr. Charles Rustling is the head, is a lively one. Rustling is well named. An electric railway has just been gotten under way at Wichita, Kan. Work will soon begin on the Armourdale contract, while in the lighting line the agency reports securing the following contracts in the last two or three weeks: Anthony, Kan., 35 arc light plant; Emporia, Kan., 50 arc light plant; Fort Leavenworth, Kan., 300 incandescent light plant; Kansas City, Mo., a 50 incandescent light plant.

K. C. M.

ENGLISH NOTES.

LONDON, Nov. 21, 1888.

The Revival of Electric Lighting.

A remarkable instance of the actuality of the revival of electric lighting in this country, about which so much is at present being said, is afforded by the fact that the well-known firm of Messrs. B. Verity & Sons have quite recently completed or commenced no fewer than 40 installations. These installations are of all sizes, from 3,000 lights to as few as 50 lights, and include yacht, club, theatre, hotel and private installations.

The London Chamber of Commerce.

The Electrical Trades Committee has decided to ask the Board of Trade to alter the definition of a unit from 1,000 to 10,000 watt-hours; the object being to enable prices to be varied within narrower limits than is at present possible. The cost of a unit in this country is now quoted at rates varying from 5d. to one shilling, and it is practically impossible to make any change amounting to less than three or four per cent. of the total charge. The alteration will be very troublesome, however, to dynamo makers, who now class the output of their machines upon the basis of the 1,000 watt unit. The committee had also under discussion the question of allowing undertakers to see that the wiring of houses which they were called upon to supply current to had been put up to their own satisfaction. This seems a perfectly reasonable demand, but it has been pointed out that it would probably give rise to difficulty in those cases where the same firm as supplies the current also undertakes wiring. If their inspectors condemned the work of other firms, trouble would undoubtedly arise. No decision has as yet been arrived at in the matter, and it is not easy to see a way out of the difficulty.

The London Vestries.

The district of Kensington still continues to occupy the attention of the rival electric supply companies. A few days ago the vestry held a very stormy meeting, lasting until after midnight, when a resolution was moved to the effect that free competition should be allowed to all companies who cared to enter the field. Upon this being carried the chairman and vice chairman of the electric lighting committee immediately resigned. Ultimately, however, their resignations were withdrawn, the resolution was rescinded and the meeting adjourned for a fortnight. The Paddington vestry also had a prolonged wrangle over the appointment of a consulting electrical engineer. The rival merits of Prof. George Forbes and Dr. John Hopkinson were discussed in a manner which was hardly seemly, but which is, I suppose, inevitable under the circumstances. Finally the services of Professor Forbes were retained at a fee of 100 guineas. You will see from this how different is the method of doing business upon this side of the Atlantic to that pursued on yours. In the States, I suppose, the work would have been simply placed in the hands of some competent firm and they would practically have been allowed to carry out the scheme in their own fashion.

The Pacific Cable Scheme.

During the last few days a circular, emanating from the Pacific Telegraph Company limited, has been issued to all the leading commercial and shipping houses of this city, inviting attendance at a conference to be held at the Cannon street hotel to-morrow (Thursday). The object of this conference is to consider a proposal submitted by the Pacific company to the governments of Great Britain, Canada and Australasia for the laying of a cable from Vancouvers Island to Australia. In return for an annual guarantee of £75,000, the Pacific Company profess their readiness to lay the cable immediately and to reduce the rate to 4s. per word, promising to give still further reductions if the traffic increases in the manner anticipated by the sanguine promoters of the scheme. The idea of a direct cable between England, Canada and Australasia, "passing through British territory throughout its entire length," as the circular somewhat curiously expresses it, is no doubt grandiose, but I can hardly believe that it will prove, even with an annual guarantee of £75,000, a paying one. From an imperial point of view, there is, perhaps, a good deal to be said for a cable across the Pacific, but commercially there is far more to be said against than for the scheme. The Eastern Extension have already two cables to Australia and another is shortly to be laid, so what prospect there is for a long, single line, stretching across the comparatively unknown depths of the Pacific, I am unable to see. If actually carried out, the scheme will probably involve a considerable loss of money, and the end of it will be purchase by the company which at present provides a very satisfactory service to our Australian colonies.

Large and Small Engines for Electric Lighting.

In view of the controversy which recently took place on both sides of the water as to the merits and demerits of large or small engines for electric lighting purposes, I think a short account of the modus operandi at the Grosvenor Gallery Station may be interesting to some of your readers. At this station, owing to force of circumstances, a very varied collection of engines has to be handled. First of all there is a 750 h. p. Corliss engine, and then come three Marshall engines; one being a 500 h. p. coupled engine, and the other two being 35 h. p. single cylinder engines. The big Corliss drives a 10,000 light dynamo direct off its 18 ft. fly wheel through rope gearing. The three Marshalls combined drive another 10,000 lighter through countershafting. Economical working under such conditions would appear somewhat difficult of attainment; nevertheless a very fair approximation to the idea is obtained in actual practice. The minimum output of the station is about 120,000 watts, which is amply sufficient to employ one Marshall engine economically. As the demand for current increases, another Marshall is started and run up to its proper speed, and is then thrown into work by means of a clutch coupling. The third Marshall is then added in the same way. As soon as the load approaches the limit of the three Marshall engines, the Corliss engine is started and the load transferred to it in the following neat manner: Each of the five external circuits is governed by a main switch enabling each circuit to be supplied from either dynamo. The dynamo driven by the Corliss engine being now run on open circuit, the load is quickly turned over to it by means of these five switches, the first dynamo being now stopped and cleaned down. As the demand continues to increase this dynamo is again started, the Marshall engines being brought into line successively and the load equally divided between the two dynamos by means of the main switches. As the demand for current declines the reverse process is gone through. All this switching on and off is so effectively done that nothing but a slight "bob" of the light is noticed by the consumer. The above would appear to point to a combination of large and small engines as perhaps after all the best solution of the problem of economical central station working. As an instance of the energy which has characterized the Grosvenor Gallery scheme from the commencement, I may mention that when Mr. Ferranti took charge of the station in the beginning of 1886, the plant consisted of only two small Siemens dynamos and one Marshall twin engine; all the transformers being in series on the mains. This plant was immediately doubled. The next step was to alter the system to the ordinary parallel one; new transformers were put up and the dynamos adapted to give constant E. M. F. and variable current in lieu of constant current and variable E. M. F. The demand upon the station now became so great that the plant soon had to be increased; four large Babcock & Wilcox boilers, a large Corliss engine and two 10,000 light dynamos were ordered. The whole of this plant was installed and the greater part of the old taken out without a moment's interruption to the service. This feat would under any circumstance be noteworthy. Considering, however, that the plant had all to be erected in what is little more than a large cellar, twenty feet below the steeet level, with a ceiling only ten feet from the floor and the whole place already crowded with machinery, I think the highest credit is due to Mr. Ferranti and his staff.

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LONDON, Nov. 28, 1888.

The House to House Electric Supply Company.

The House to House Electric Supply Company, whose central station at West Brompton is now approaching completion, have recently issued a circular to the residents of that district of the metropolis. The requirements of the Board of Trade are briefly set forth, as well as the method of supply and of assessing the charge for the light. The station will be run on the Lowrie-Hall system and each consumer is to be supplied with a meter. The quantity of electricity actually consumed will be ascertained quarterly and the charge made on the basis of a sliding scale, varying with the maximum supply demanded by the householder, the average tariff being 8d. per Board of Trade unit.

Compound Winding Litigation.

The validity of the claim of the Anglo-American Brush Corporation to the exclusive right to compound wind is now being tested in the Scotch courts at Edinburgh, where Messrs. King, Brown & Co. are bringing an action against the corporation requiring them to show cause why their patents should not be annulled. The principal allegations on the part of the "pursuers" are as follows: The alleged inventor was not the first and true inventor; the alleged invention was publicly known and used prior to the date of the letters patent; the letters patent do not embrace any subject matters for which a patent could be granted; the final specification does not conform to the provisional one; the subject matter of the alleged invention is not indicated by the title; and, finally, the specification is not so expressed as to be intelligible to a workman of ordinary skill. The anticipations relied on are those of A. M. Clark, No. 4,311, Dec. 11, 1875, and S. A. Varley, No. 4,905, Dec. 19, 1876; also the well-known paper of Professor Charles Wheatstone, read before the Royal Society on the 14th of February, 1867, "On the Augmentation of the Power of a Magnet by the Re-action Thereon of Currents Induced by the Magnet Itself." It is further alleged by the plaintiffs that the said invention was publicly made and used by Messrs. Siever & Gorman at their works in Westminster in the years 1876-77, and by the Electrical Engineering Company, of Ancoats, Manchester, during the last twenty years. At the time of writing the action has not been carried further than the examination of the first witness on behalf of the plaintiffs, Mr. John Imray, who has been engaged in almost every electrical patent case of importance in this country. Mr. Imray was put forward chiefly with a view of instructing the court on the theory and practice of dynamo-electric machinery, and partly also with a view of initiating it into the mysteries of series, shunt and compound winding. The hearing of the case is expected to extend over four or five days, and doubtless the judgment will be postponed for some weeks. We are now on the eve of a great revival of electrical patent litigation. In addition to the above case there are two appeals pending in our own courts; on Thursday the Gaulard-Gibbs v. Ferranti action is set down for hearing, and on Saturday the Edison-Swan v. Holland and others appeal comes before the same court. Three of the most important electrical patents, namely, those for compound winding, transformers and incandescent lamps, are thus likely to simultaneously engage the attention of the law courts. I may mention in this connection that I have just heard of the decease of M. Lucien Gaulard in a madhouse near Paris; as my informant expresses it, "he died broken hearted, a victim to science." Whatever may be thought of his scientific claims, I trust the claim of M. Gaulard to have made a commercial success of the transformer will not be ignored by those who have profited by his mistakes.

Storage Batteries for Electric Traction.

The two leading electrical papers in this country have lately been discussing the question of the use of accumulators for electric traction purposes, and I notice a somewhat sharp divergence of opinion. In a leader entitled "The Future of Electric Tramway Traction," the *Electrical Review* asserts that "Mr. Sprague himself was compelled to admit that accumulators are the only safe means as a motive power for street cars, and are, therefore, to be looked forward to in the future as the solution of the difficulty of electric traction for cities and public thoroughfares." Adding very complacently, "All this is very gratifying, but it does not in the least take us by surprise, as in this country there are not many electricians with experience in electric locomotion who would think otherwise, and we must take it that this question has already been settled in everybody's mind." The *Electrician* demurs at this sweeping statement, pointing out that Mr. Sprague said nothing of the kind. Some ideal battery must, I think, have been present in the writer's mind when inditing the above lines, not the actual heavy, quickly-depreciating apparatus now yclept

storage battery. The *Electrical Review* moreover does not believe that lightness is the great desideratum in batteries required to do tramway work. "What is required in an accumulator is not a large amount of storage capacity, coupled with a minimum of weight, but rather something that will contain a working capacity for, say, between three and four hours on the best mechanical construction." This, no doubt, is a very sound statement, but when the *Electrical Review* goes on to say that an accumulator enabling a car to run only 20 miles without recharging is all that is required, it deviates, I am afraid, into the regions of the unpractical. What, for instance, were the conditions laid down by the Birmingham Central Tramway Company in the recent trial of the Julien car at Birmingham? The engine was to be able to draw the existing cars, without alteration or conversion of form, along any of their steam routes; the cost of traction and depreciation was not to exceed that of steam locomotion, and *the "electrical engine" was to perform a full day's work of 60 miles without recharge.* Conditions like these are, for obvious reasons, far more likely to be the rule than the exception. Hence the problem is to make the battery fit the conditions, and not, as the *Electrical Review* would have it, to make the conditions fit the battery. On the whole, therefore, I am inclined to think with the *Electrician* that the storage battery will have to be greatly improved in the direction of lightness, capacity, solidity and durability before we can look upon it as affording a genuine solution of the electric traction question.

LONDON, Dec. 5, 1888.

King, Brown & Co. v. The Anglo-American Brush Corporation.

The trial of King, Brown & Co. v. The Anglo-American Brush Corporation was resumed in the Edinburgh court on Wednesday last. Dr. John Hopkinson deposed that in Brush's patent there was "no indication of a desire to have a machine of constant potential;" if a machine were constructed upon the basis of the specification it was exceedingly improbable that constant potential would be produced. That entirely depended upon the ratio of the lengths and resistances of the two coils and upon the speed of the machine, concerning which nothing was said in the specification. He admitted that neither in Varley's specification was a method of making a constant potential machine disclosed. He did not think that either of them had that end in view. He was, nevertheless, clearly of opinion that what Varley had described was a series-shunt machine, and in so far he had anticipated Brush. In cross-examination he was asked whether it was possible to give general directions which would secure constant potential; witness admitted that it would be necessary to make separate calculations for each type of machine, and no such general directions could be given. Mr. Samuel Varley, who was next examined, deposed that from 1861 to 1866 he tried to make a self-exciting dynamo, and that in the latter year, in conjunction with his father, Cornelius Varley, he took out a provisional specification for such a machine; that machine was now in the South Kensington Museum. With regard to the specification of 1876, his own view was that it described a series shunt or compound-wound machine. He had a machine constructed in accordance with that specification at the works of Messrs. Siebe & Gorman, of Westminster; he had in his possession a private note-book, in which, before constructing the machine, he had drawn a diagram which clearly showed his intention to employ both series and shunt windings. He had not made any claim in the final specification on this point because he was under the impression at the time that his brother, Cromwell Varley, had already made the same discovery and he wished to avoid legal differences with his brother. His specification also described a certain form of arc lamp, and it was absolutely necessary in order to insure the proper working of that lamp to use a constant potential machine; it would not have worked with a plain series or plain shunt. In cross-examination witness repeated that the only reason why he had so long abstained from claiming the invention was because he was afraid of being involved in litigation with his brother. The passage in his brother's paper which he at that time feared had anticipated his own invention was as follows: "The force expended in the shunt is wasted in heat, but a secondary wire on an electro-magnet or a copper cylinder would very greatly add to the power of maintaining the magnetism and not consume the useless force now wasted on the shunt." The witness was cross-examined at considerable length upon the wording of his specification, in which he certainly employs somewhat involved and archaic language, with regard to the conversion of magnetism into electricity, and vice versa. Witness admitted that when the Crompton litigation collapsed he had sought an interview with Mr. Sellon, vice-chairman of the Brush Corporation, such interview to be without prejudice. He had then stated the terms upon which he was willing to surrender his patent rights, but his proposals had been declined.

The following day (Thursday) a number of lads were placed in the box, who carried models of compound-wound field magnets, which they were alleged to have constructed from the details in Varley's specification. None of these clever youths had hitherto studied electrical engineering or had ever heard of compound-winding. Mr. James Swinburne, on being placed in the witness box, agreed with Dr. Hopkinson that Brush's specification contained no hint as to constant potential, though it clearly described a series-shunt winding. Assuming the machine to be made in terms of that specification it would not at all necessarily follow that it would give constant potential. If the relative diameters of the wires were taken as nearly as possible from the drawing, he believed that the machine would lose its field on open circuit. He found nothing disclosed in Brush's specification as to series-shunt winding which was not already disclosed in Varley's. It had been suggested on the part of the "defenders" that what Varley really described was a doubly wound field intended to be separately excited from independent sources; witness gave reasons in considerable detail disproving this view. He had measured the resistance of the armature and field-magnet coils of Varley's machine and found about 9 ohms for the armature, 8 ohms for the large wire coil and about 10 ohms for the small wire coil. In cross-examination he admitted that he had never heard of a series-shunt wound machine before that of Brush. In the Crompton case the defendants had submitted to an injunction and paid the Anglo-American Brush Corporation £2,000. Professor Ewing, of Dundee, gave evidence of a similar character to that of the preceding witness. Mr. A. B. Brown, one of the pursuers, said that with regard to the recent action brought by the Brush Company against the Orient Steam Navigation Company his firm had declined to have anything to do with the action.

The case for the "defenders" was opened on Friday, when Prof. S. P. Thompson deposed that in his view Brush's specification disclosed a most valuable step in advance. There had been various attempts to regulate the electric current by devices which required moving by hand, but an automatic arrangement of this kind, depending upon the compensation given by the two windings, was at that date entirely new. He had tested a machine built according to Brush's drawings and from Brush's specification, and he found as a matter of fact that it gave an approximately constant potential. He did not see how Brush could have usefully imparted any further instructions regarding proportions, etc., than those which were contained in the specification. Had he endeavored to be more precise, he would probably have been misleading. Varley's specifications did not appear to him to be for the same thing at all. It contained several electrical absurdities. He did not believe that Varley intended to make use of any series winding, at any rate such a supposition was inconsistent with the most obvious interpretation of the wording. He believed that the two windings on the field magnets were to receive current from separate sources, either within or without the machine. Cromwell Varley's communication, where there was a reference to a secondary wire or copper cylinder, did not suggest to him any resemblance to the series-shunt arrangement. He had examined Varley's machine, made by Siebe & Gorman. There was nothing in it to show how it was coupled up when used. There were an unnecessary number of terminal screws, and these would indicate that it was intended to try coupling up the machine in various ways. In cross-examination witness was handed a copy of the *Electrician* of Oct. 28, 1885, containing a "characteristic" of a Brush plating machine of the early type. He admitted that this showed a variation of nearly 20 per cent. in the potential.

THE TELEGRAPH.

The Commercial Telegraph Company has been incorporated by W. G. Park and others.

The Postal.—It is reported from New York that the Postal Telegraph Company contemplates an extension through the Southern States, and that construction will be commenced south from Washington within a short time.

THE TELEPHONE.

Telephone Dividend.—The Bell Telephone Company has declared a regular dividend of 3 per cent. for payment Jan. 15 to stock of Dec. 31, the books to be closed from Jan 1 to 14 inclusive.

Drawbaugh Again.—The government want to amend the bill against the American Bell Telephone Company, in the Massachusetts Circuit Court, so as to base the action more specifically on Daniel Drawbaugh.

A Telephone Defalcation.—Through the vigilance of Mr. F. W. Jones, the general manager of the West Coast Telephone Company, Mr. W. A. Bushnell, who has been living in South America, under the name of G. F. Hanson, has been arrested at Santiago, Chili, on the charge of embezzlement of $18,000 from the company while its general manager in Chili.

A Telephone Auto-da-fe.—A special dispatch from New Orleans of Dec. 12 states that Mr. F. B. Knight, special agent of the American Bell Telephone Company there, burned up in that city on the day named 950 infringing telephones which had belonged to the National Improved, Crescent City and New Orleans telephone companies, and which had been delivered up to the Bell Company by order of the court.

THE ELECTRIC LIGHT.

North Manchester, Ind., is to use arc lights.

Mobile, Ala., is to have a Thomson-Houston plant of 85 arc lights.

Barre, Vt., will have a 35-light Thomson-Houston arc plant running by Jan. 1.

Fergus Falls, Minn., has seen a consolidation of its gas and electric light interests.

Pocomoke City, Md.—Details as to the proposed electric lighting can be had from the Mayor.

Annapolis, Md.—The Annapolis Electric Light Company have secured a site for their station.

Cambridge, Mass.—The Cambridge Electric Light Company is to increase its capital stock from $100,000 to $200,000.

Columbia, Tenn.—It is stated that Mr. A. C. Green, of Fayetteville, has contracted to put in an electric light plant for $14,000.

Cleveland, O.—Another Brush incandescent plant has just been placed in the works of the Standard Oil Company, Cleveland, Ohio.

Denver, Colo.—The Colorado Electric Company, of Denver, Colo., have recently added a number of Brush arc lamps to their plant.

Nashville, Tenn.—Bids for a term of three years for electric lights, to begin next May, are called for by the Nashville Board of Public Works.

Lenox, Mass.—The Lenox Gas and Electric Company has been incorporated by W. R. Plunkett and others, with a capital stock of $80,000.

Carthage, Mo.—The Carthage Electric Light and Power Company has been incorporated by W. B. Myers and others, with a capital stock of $30,000.

Bay Shore, L. I.—The Bay Shore Electric Light Company has been incorporated by W. W. Herlee, C. W. Vail and others with a capital stock of $8,000.

Albion, N. Y., is to have a Thomson-Houston plant of 13 arcs and 66 incandescents, to cost $2,000 a year.

Chattanooga, Tenn.—The Chattanooga Electric Light Company will move their station, and have contracted with the Thomson Houston Company for a capacity of 200 arcs.

New York City.—The West Side Electric Light and Power Company, of this city, has been incorporated by E. L. Striker, H. B. Russ and J. Quinn, with a capital stock of $100,000.

Geneva, N. Y.—The demand for electric lights in Geneva, New York, has lately increased to such an extent as to necessitate the ordering of another 30 light Brush machine and lamps.

Mount Vernon, N. Y.—The People's Electric Light and Power Company, of Mount Vernon, has been incorporated by W. A. Armstrong, W. Hart and others, with a capital stock of $100,000.

Maysville, Ky.—The Maysville Electric Light and Power Company, to put in an Edison plant, has been incorporated by M. A. King, G. S. Rosser, W. W. Ball and T. M. Dora, with a capital stock of $12,000.

Greencastle, Ind.—The purchasers of the Greencastle Electric Light Company, the sale of which was recently mentioned, are G. T. Stewart and C. J. Watts, of Springfield, O., who will increase and improve the plant.

Washington, D. C.—Mr. J. W. Powell, of the Treasury Department, is preparing plans and estimates for the use of the Committee on Public Buildings for the lighting of the entire House wing of the Capitol. About 3,000 lights will be required.

Mexico.—The Brush Electric Company, of Cleveland, Ohio, have lately received an order for a machine having a capacity of 30 2,000 candle-power lamps, together with a full complement of lamps for the same, to be used for the central station lighting in Mexico.

Brooklyn, N. Y.—The Van Depoele Electric Manufacturing Company of Illinois, which now supplies electricity to the Jamaica Electric Road, has applied to the Brooklyn Aldermen for a franchise for the lighting of the streets in the Twenty-sixth ward.

Lafayette, Ind.—The Brush Electric Company, of Cleveland, have recently sold to the Brush Electric Lighting Company, Lafayette, Ind., one 300-light incandescent machine and one 45-light arc machine, with dial, etc. This is for increasing the plant at Lafayette.

New Orleans.—Mr. G. C. Hill, southern agent for the Sawyer-Man Electric Light Company, has recently been putting in a 200-light plant for the Crescent City brewery, and has also sold 2,000 Sawyer-Man lamps to the Custom House, which is operating an Edison plant.

San Francisco, Cal.—The parent Brush Company have just received orders from the California Electric Light Company, of San Francisco, Cal., for three No. 8 machines, to increase the capacity of the San Francisco station, and five No. 8 machines, with complement of lamps, to be used for central station lighting at Portland, Ore.

Carbon Litigation.—The Brush Electric Company has brought action against the National Carbon Company for an infringement on patents for improvements in carbons, and the mechanism for manufacturing them. The court is asked to restrain the defendants from a further infringement, and also to award damages to the complainant.

Elgin, Ill.—The city authorities of Elgin, Ill., have awarded the contract to furnish an electric light plant to that city to the Jenney Electric Company, of Indianapolis, for $18,190. The plant will consist of a 100 h. p. engine, dynamo capacity for 105 lights; 8 towers, 15 miles of circuit, and 80 arc lamps, 32 of which to be on towers, and the rest suspended at street intersections. The bids of other companies ranged from $13,000 to $21,000.

Nashua, N. H.—It is reported on good authority that the Nashua Electric Light Company has secured a controlling interest in the Nashua Light, Heat and Power Company, having purchased of the Nashua and Jackson Cotton Manufacturing Company's stock to the amount of $80,000. This, it is stated, will end the controversy concerning lighting the streets with gas or electricity in favor of the latter, the contract for which will probably be renewed with the electric company by the incoming city administration.—*Boston Jour. Com.*

Seattle, W. T.—About three months ago the Oregon Railroad Navigation Company put in a Waterhouse plant of 35 arc lights. Four weeks after a lumber mill did the same thing, using about seven-tenths capacity for its own purposes, and renting the other lights at a low rate to neighbors. Now some half-dozen merchants, all located in one row, have combined together for purchasing a third Waterhouse 35-light plant. This is a pretty good show for progress and activity in a town of from 1,800 to 2,000 inhabitants. There are running in the town also 100 arc lights, American system and Thomson-Houston; but as the above shows, private plants are very much in vogue.

Pittsburgh, Pa.—After a long period of doubt and dicker, an award has been made of the new electric lighting contract at Pittsburgh, Pa. The East End Electric Lighting Company has received the contract for lighting the entire city with arc and incandescent lamps, the whole to cost the city annually $110,592. The Waterhouse system of arc lighting will be used in conjunction with the Westinghouse system for the incandescents. It is figured out that the cost of arc lights per night to the city will be about 29 cents, which is a pretty low rate, explained by the fact that natural gas is used under the boilers. This contract has been dangling in the air for a long time, and the people of Pittsburgh are very glad that the award has been made and that the lights will soon be up.

Cherryfield, Me.—The Cherryfield Electric Light and Power Company was organized during the past summer with a capital stock of $7,000, of which $4,000 was paid in. The plant was installed by Mr. C. B. Storey, now of Brunswick, Me., under contract. The dynamo is driven by water power, and is supplemented by storage batteries. The company now has 100 cells of battery, and so far has restricted itself to incandescent lighting. It is supplying about 250 lights of 10, 16 and 32 c. p., but mostly of the latter. The plant seems to work very well, and has now been running about three months. The stockholders are all citi-

zens of the town, and are 10 in number, including Mr. W. M. Nash, the lumber merchant, as president, and Mr. D. W. Campbell as secretary and treasurer.

APPLICATIONS OF POWER.

Montgomery, Ala., will probably soon have a new station in place of the one destroyed by fire, for the electric road.

The American Electric Railroad Company, of Chicago, has been incorporated by H. Henry, H. Edgell and S. H. Emmens, with a capital stock of $1,000,000.

Tacoma, W. T.—A syndicate comprising Henry Villard, D. H. Louderback, Paul Schulze and others are to acquire the local street railway and put the Sprague system in.

The Silvey Company, of Lima, O., have decided to add to their business the construction of electric railways. They now have a 100 h.-p. generator in use for the Lima electric road.

Newburyport, Mass.—The Thomson-Houston Company have contracted to equip the Merrimac division of the Newburyport & Amesbury Railway. Three cars will be used at the start.

Brooklyn, N. Y.—The Prospect Park & Coney Island Railroad has decided to substitute electricity for the horse power used on its branch road from the Brooklyn city line to West Brighton Beach.

Julien Storage Batteries.—The Julien Electric Company sold 2,130 cells of their battery during the month of November, and 813 in the current month up to the 13th inst., for central stations, motor service, car lighting and other work.

Seattle, W. T.—Mr. Gustav Lockemeyer writes us from Seattle that he considers the Pacific coast the ideal climate for electric railroads, as no lightning ever takes place there to damage the overhead contacts. This may be one reason why there is so much activity displayed in electric railroading west of the Rockies.

Electricity Supplanting Steam.—The New York *Sun* has just published a very interesting article on the manner in which electrical power is rapidly being substituted for steam power in industries both large and small; and it cites the case of Mr. A. Gray, in this city, who is supplying power on the Daft system to 150 customers west of Broadway and below Canal street. It appears that the Salvation Army newspaper, the *War Cry*, is printed on an electric press.

New Haven, Conn.—A petition will be presented at the next session of the General Assembly of Connecticut asking for a charter for a railroad with cars to be propelled by electricity or animal power for New Haven. The promoters of this new road are Treadwell Ketcham, William W. Converse, Thomas G. Bennett, Judge Joseph Sheldon and George H. Morely. The surveyors and engineers have gone over the proposed route and have made a complete plan of the same. They have reported that the average cost of the road will be $6,000 per mile. All the necessary capital for the starting of the enterprise is at hand, and if the action of the legislature is favorable work will be begun as early in the spring as the condition of the ground will permit.

PERSONALS.

Mr. Lucius J. Phelps, the well-known electrician, is now in business as manufacturer of the "Domestic" gas engine, burning gasoline, and useful for small electric light plants.

Mr. George E. Devyr has some neat verses in the Christmas *Puck* on the "telephone girl," to whom they pay a well-deserved compliment. They are entitled "Hullo, Hullo!"

MISCELLANEOUS NOTES.

Akron, O.—The Akron Electric Manufacturing Company, recently incorporated, has a capital stock of $150,000.

Orange, N. J.—The Essex County Electric Company has been incorporated by Stuart Lindsley and others, with a capital stock of $100,000.

A Mistake.—A correspondent points out that in the formula given at the top of the first column, on page 263, of our issue of Nov. 17, the factor "188" in the numerator should be 324. This is a missprint, as a calculation and the result show that 324 was the number intended; the solution given, $n = 463$, is therefore correct.

Electrically Welded Bale Ties.—The Thomson Electric Welding Company have perfected a machine for welding cut bale ties. By its means cut ties can be easily united, and the pieces that accumulate at the compresses, which are so well known in the South, can be very quickly made up into proper lengths for use. At the present time the cut band ties, though in large quantities, are worthless, except as scrap iron. The task of working up the scrap will be done in the North, but the Southern papers suggest that it would be easier and cheaper to do it down in Dixie.

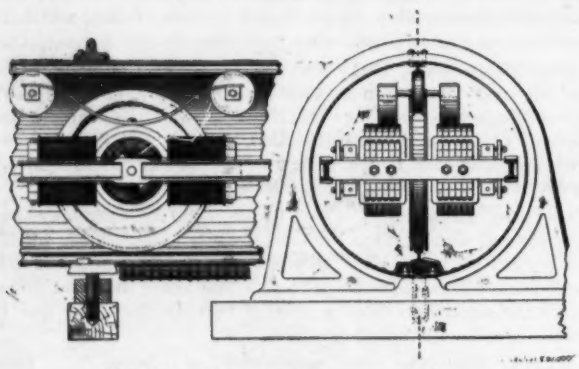
BUSINESS NOTICES.

Jordan & Gottfried, 208 Canal Street, N. Y., carry a complete stock of iron and brass machine wood screws, bolt, cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS ISSUED DEC. 11, 1888.

394,161. Electric Dispatch Tube; W. Dulles, Jr., New York, N. Y., Application filed April 14, 1888. A dispatch tube consisting of a cylinder supported on suitable yokes and having a longitudinal opening in the bottom thereof covered with foraminous material, a bearing conductor supported above the



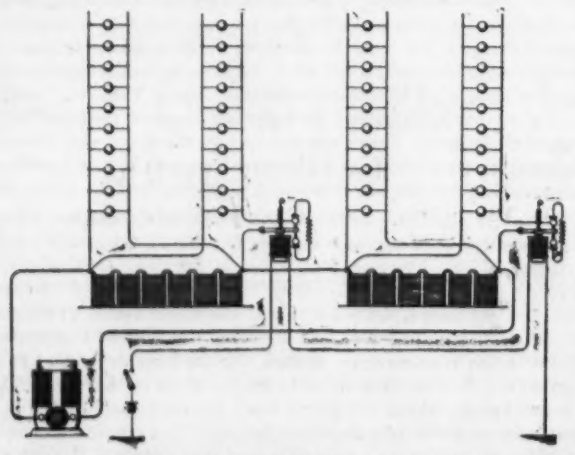
394,161. ELECTRIC DISPATCH TUBE.

foraminous material, and a guiding conductor supported in the top of the tube. See illustration.

394,164. Electric Contact Maker; J. S. Farmer, Salford, England. Application filed Aug. 27, 1888. An electric contact maker consisting of two vessels mounted on an axle, and containing a mobile electrical conductor with a channel connecting the vessels. The whole is so arranged that when the mobile conductor is in the lower vessel, and the position of the two vessels is reversed, the flow of the said conducting material from the upper into the lower vessel completes the electric circuit.

394,172. Signaling Dynamo-Electric Machine; Elisha Gray, Highland Park, Assignor to the Western Electric Co., of Chicago, Ill. Application filed Jan. 3, 1881. The invention relates to substituting for the permanent magnet in a call-box an electro magnet energized by the local battery made common to the transmitter and the electro-magnet.

394,173. Ringing-off Device for Telephones; A. Griffith and H. A. Burbank, Westfield, Mass. Application filed



394,541. ELECTRIC DISTRIBUTION BY SECONDARY BATTERIES.

Aug. 2, 1888. Improvements having for their object the provision of devices whereby the instrument automatically causes an alarm bell to be rung in the central office when the parts thereof, after a conversation, are returned to their normal position.

394,180. Cut-out for Electric Lamps; Charles Heisler, of St. Louis, Mo. Application filed May 17, 1886. A thermal and an electro magnetic cut-out in operative proximity to each other, the thermal cut-out being brought into operation by the overheating of the coils of the electro-magnet, resulting from the imperfect action of the magnet or its total failure to act. See illustration.

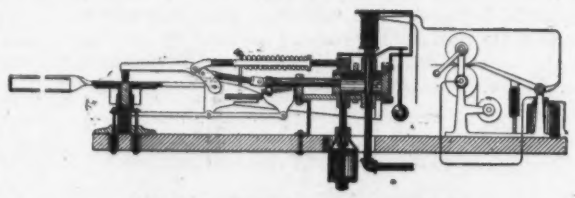
394,195. Bridge for Cutting in New Loops in Telephone Systems; Geo. S. Maxwell, Louisville, Ky. Application filed Dec. 13, 1887. In a telephone system a parted line wire, fixed supports for the parted ends, and a removable bridge wire electrically connecting the parted ends, and each of the ends being provided with a free end, whereby another wire may be attached.

394,267. Electric Underground Conduit; David O. Paige, Detroit, Mich. Application filed March 21, 1888. The wire or wires are each imbedded in and thoroughly surrounded by a plastic mass composed of silicious material, which upon the application of heat will become vitreous, and will thoroughly and permanently support and insulate the conductor or conductors.

394,230. Telephone Central Station Apparatus; T. N. Vail, Boston, Mass., and John A. Seely, of New York, N. Y. Application filed Aug. 31, 1888. The improvements consist in connecting the terminals of a local circuit containing a listening telephone to opposite sides of a pair of united metallic circuits. This produces no preliminary break and no interruption of variation whatever. See illustration.

394,296. Acid Proof Receptacle and Lining Therefor; E. R. Rand, Newton, Assignor to the Boston Car Spring Co., of Boston, Mass. Application filed April 19, 1887. The invention consists partly in a lining or covering for a rigid case or frame, said lining being composed of vulcanized rubber made into a bag or receptacle, having its exterior size and shape correspond with the interior size and shape of the rigid receptacle.

394,302. Printing-Telegraph; George V. Sheffield, of Schenectady, N. Y., Assignor to himself and Lewis Sickler, of the same place. Application filed Dec. 31, 1887. The invention consists of a transmitter formed of two rollers adapted to carry forward a perforated sheet of paper: a series of spring-actuated fingers held in contact with one of the rollers of the paper, a number of line wires corresponding to the number of



394,302. PRINTING TELEGRAPH.

fingers in the transmitter; a receiver consisting of a series of steam cylinders arranged in a circle and connected with printing levers; an electro-magnetic device connected with cylinder and with one of the line wires, and a series of whistles connected with the steam cylinders and adapted to be operated by the exhaust. See illustration.

394,332. Electro Mechanical Movement; B. Cadwallader, Chicago, Ill., Assignor to the Inter-Ocean Electric Company, of same place. Application filed Aug. 26, 1886. The combination with a wheel adapted to be rotated in both directions, two independent electromotors connected with said wheel, one for propelling said wheel backward by a step by step motion, and a transmitting device operating each of said electromotors by a series of independent electric impulses transmitted by the sending mechanism to either of said electromotors at will, whereby the units of motion of said wheel in either direction are dependent upon the number of electrical impulses transmitted to the electromotor which moves it in that direction.

394,380. Wire Holder for Insulators; Edwin L. Lloyd, Philadelphia, Pa. Application filed Feb. 13, 1888. A wire holder for insulators consisting of a loop having a wire receiving eye open for the insertion of the wire, but having portions extending below, in front of, above and in the rear of a wire passing through the eye.

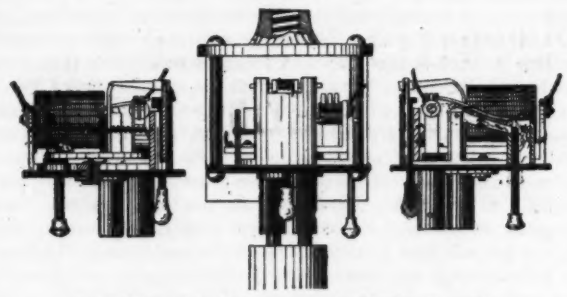
394,417. (2) 394,525. Safety Devices for Electric Motors; C. J. Van Depoele, Chicago, Ill. Applications filed June 6, 1888. The inventions consist in interposing between the commutator and field magnet connections and the main terminals of the machine a piece or section of insulating material of less insulating capacity—that is, more easily destroyed or punctured than the insulation upon the wires with which the various parts of the motor are wound. It follows from this construction that on the presence of dangerous extra or other current it will necessarily find outlet through the safety device, destroying the same, but thereby protecting or saving the rest of the machine.

394,471. (2) 394,472. (3) 394,473. (4) 394,474. Secondary battery plate and Method of Making Same; Louis Duncan, Baltimore, Maryland. Applications filed May 12, 1888. For description see page 334, this issue.

394,485. Electro-Magnetic Switch; W. W. Griscom, Haverford College, Pa. Application filed Aug. 10, 1888. The object is to provide a durable and efficient circuit breaker for use in charging secondary batteries.

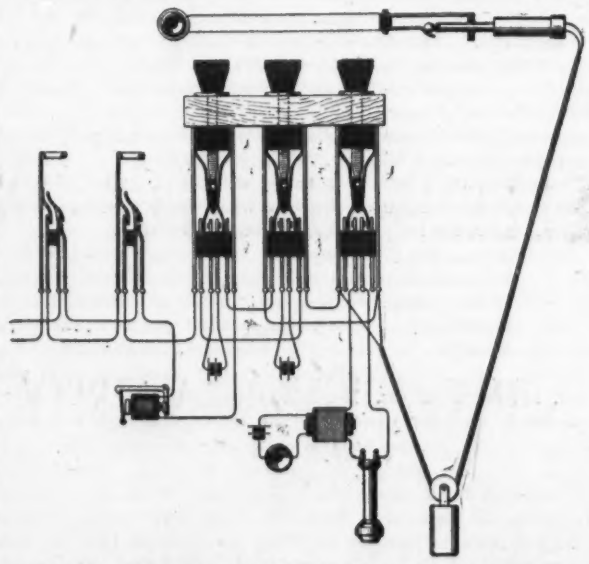
394,491. Electric Alarm and Water Gauge; John H. Johns, National Military Home, Kansas. Application filed Feb. 4, 1888. A float upon the surface of the water operates vertically a rod which closes an electric circuit when the rod has moved to extreme positions above and below.

394,541. Electric Distribution by Secondary Batteries; Zach. Latshaw, McKeesport, Pa. Application filed



394,180. CUT-OUT FOR ELECTRIC LAMPS.

June 27, 1888. The improvement consists in the arrangement of apparatus and circuits as follows: At each sub-station where there is located a series of cells; the working circuit is divided into two sections, one of which contains the translating devices designed to be supplied by the battery at its normal rate of discharge, and the second section contains that portion which it is expected will be fed by the dynamo. In the main lead of this second section is placed an electro-magnetic circuit-changer, which is to be operated by a separate and independent circuit from the central station, so that when the dynamo fails for any reason to contribute its share to the maximum consumption the attendant at the central station can, by closing the special switch-controlling circuit, break the working-circuit and insert an artificial resistance in the working-circuit, thus preventing injury to the battery. The temporary break



394,230. TELEPHONE CENTRAL STATION APPARATUS.

causes a momentary failure of the light, and this is immediately followed by a return of the light operated below its normal candle-power—an effect due to the insertion of the artificial resistance—and this acts as a predetermined signal to inform the sub-station of the temporary stoppage, while only partially depriving the station of light.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, N. Y.